STREET & SMITH'S

October 1954

Astounding SCIENCE FICTION

BRITISH EDITION 1/6

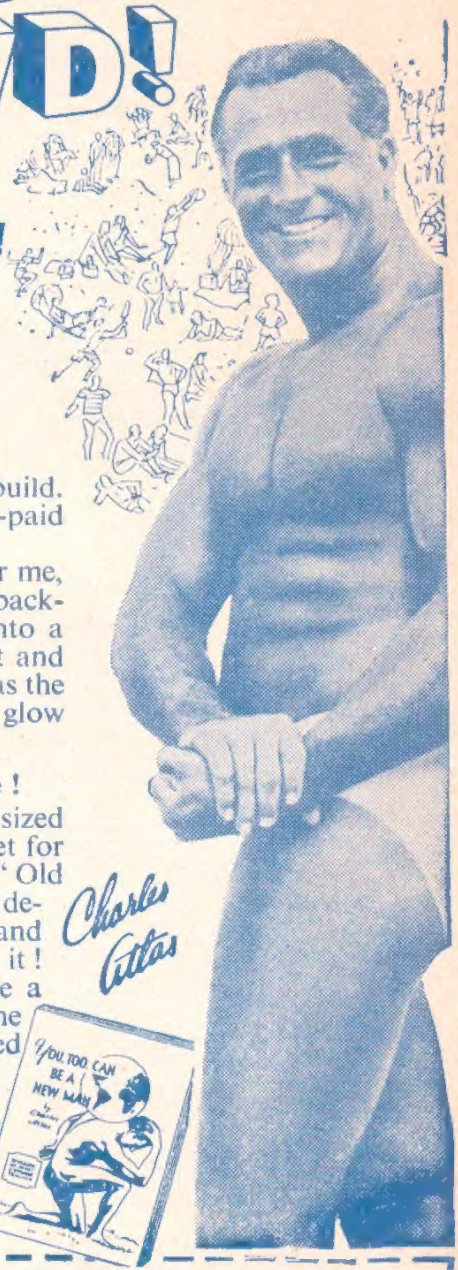
At Death's End BY JAMES BLISH

I'll prove in only 7 DAYS that I can make you...

STAND OUT IN A CROWD!

. . . or it won't cost you a penny!

FED up with being only half a man? Do you want big, rippling muscles and a massive he-man build that will make you stand out in a crowd? I've got the answer—" Dynamic-Tension ". *In only one week* I guarantee you'll see results.



WHAT'S MY SECRET?

Imagine the confidence a man draws from a powerful build. You'll find yourself the lucky one who wins the best-paid job, has the best-looking girl round your way!
What this secret, easy-to-follow training method did for me, it can do for you! From a puny, weak-chested back-number, my " Dynamic-Tension " will develop you into a modern Hercules. It will put big inches on your chest and biceps—swell your legs into perfect proportions. And as the muscles begin to ripple under your skin you'll feel the glow of new, complete health.

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As a kid and in young manhood I was a sickly under-sized scarecrow. I weighed only 97 pounds—and was a target for every big bully to push around. They used to call me " Old Bag-of-Bones ". You know that feeling of rage and despair that made me look for an answer—for a build and health I could be proud of. And at last I found it! " Dynamic-Tension ", as I call my easy system, made a new man of me. It gave me the body that twice won the coveted title, " The World's Most Perfectly Developed Man."

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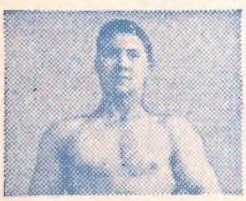
Send for my book that tells the stories of my pupils and what I did for them. See what I can do for YOU. Post coupon to: **CHARLES ATLAS (Dept. 197/K), 2 Dean St., London, W.1**

Here's PROOF from some of my Pupils!



" Gained 17¾ inches in measurements. Can lift 8 h.p. car from ground." (V.M., B'pool.)

" Feel a different man —full of pep, courage, vitality and strength." (L.O., S. Africa.)

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Send me a copy of your 32-page book, " You, Too, Can Be A New Man." FREE and details of your amazing 7-DAY TRIAL OFFER.

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Astounding SCIENCE FICTION

Vol. X, No. 10. (British Edition) October 1954

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COVER BY VAN DONGEN • Illustrations by Freas and van Dongen

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• NEXT ISSUE ON SALE OCTOBER 20, 1954 •

Editorial

PRODUCT OF HIGHER SCIENCE

AGAIN and again in science fiction there occurs the theme of Man-discovers-machine-of-alien-and-higher-science, the results constituting the take-off point of the story. Let's try a new slant on that.

I have a device which I know to be the product of a far higher understanding of the laws of the Universe than Man has yet discovered. It's a mechanism that has some perfectly incredible powers, and unquestionably applies basic knowledge that is thousands or tens of thousands of years ahead of anything human Science has yet discovered.

Any scientist genuinely interested in investigating this product of a definitely higher science is welcome to do so. Among the fields that should be highly interested are the computer technologists, chemists, logicians, and mathematicians. The device is capable of doing what no human-designed computer has yet approached doing —generating a new problem, and solving it.

The device is the result of thousands of megayears of development and testing; it has been so perfected that it is capable of self-repair, in large degree, self-maintenance, and even of self-construction, given only raw materials and the necessary blueprints.

Certainly I'm talking about a living animal; it *is* an expression—a product —of a far higher science than we now understand. It's worth studying *not as a thing*, not as a system-in-itself, but as a *product*. Any animal, down to the level of the single living cell, is a product of the laws of the Universe, and involves laws enormously beyond our present science.

The other day, Alejandro, who's done some covers for us, and is a first-rate fine-arts painter in his own right, and is so because he's an astute and understanding observer, pointed out this problem:

Suppose you have the problem of arranging an entrance-way into a space which must be atmosphere-conditioned, with humidity and temperature control, but which must also be continuously open to access by large numbers of workers. The situation requires that the entrance-way *both* be continuously open and continuously closed. The entrance-way will evidently have to compromise the two exclusive requirements. How can this be done most practically?

The problem Alejandro pointed out is that most people don't notice that that problem has long since been solved, and is a familiar, every-day problem; the device answering the requirement is so familiar we don't consider the simple neatness with

which it fulfills the conditions. The above problem is simply a description of the functional nature of a revolving door—always open to permit free access of large numbers of people, yet always closed to prevent free mixing of internal and external atmosphere. It's a simplified conveyor-belt air lock!

The computermen have some tough problems—but they haven't even considered tackling problems of the magnitude that living organisms solved two billion years ago. Since that day, organisms have evolved and simplified the solutions considerably. Sure, the organism is more complex—but the solutions are simpler!

Stress analysis engineering is a pretty new field. You know the ugly, lumpy, twisted look a human thighbone has? Brother, it's beautiful! Ask a stress-analysis engineer what he thinks of that thighbone. Knowing what little he does of the immensely complex field of stress-analysis, he sees in that twisted, lumpy shape an exquisite perfection of form. It's a stress-member that carries incredible loads around a 45° angle. It's known that a man can lift a load of twelve thousand pounds with a harness attached to his waist. Any design that permits a slender piece of porous stone to carry a three-ton load around a cockeyed angle like that is spectacularly beautiful.

We have right here on Earth, and right now, ready to hand, a whole series of mechanisms, devices, that employ the principles of sciences ten thousand years ahead of anything we humans have worked out consciously. We have, right at hand, precisely the science-fiction proposition of the product of an alien science, far in advance of human science. Since "science" has been defined as "an organized body of knowledge," I suppose we can't say that living animals are "the products of a science." But they definitely are systems applying, in a highly organized manner, very fundamental laws of the Universe.

The mathematician, the topologist in particular, could do a great deal of studying of the development of an embryo; it's one of the most remarkable systematic developments of a topological system imaginable.

The mathematician could, perhaps, help the psychologist in that. The human mind doesn't suddenly spring into being, turning on like a thrown switch. It develops. The place of instincts can be debated, but one instinctive development of mentality is clearly beyond debate: Man has instinct-conferred mechanism for learning. It is self-evident that you don't *learn* the basic processes of learning; by definition, that's impossible. A system that is not already capable of learning obviously can't be *taught* how to learn.

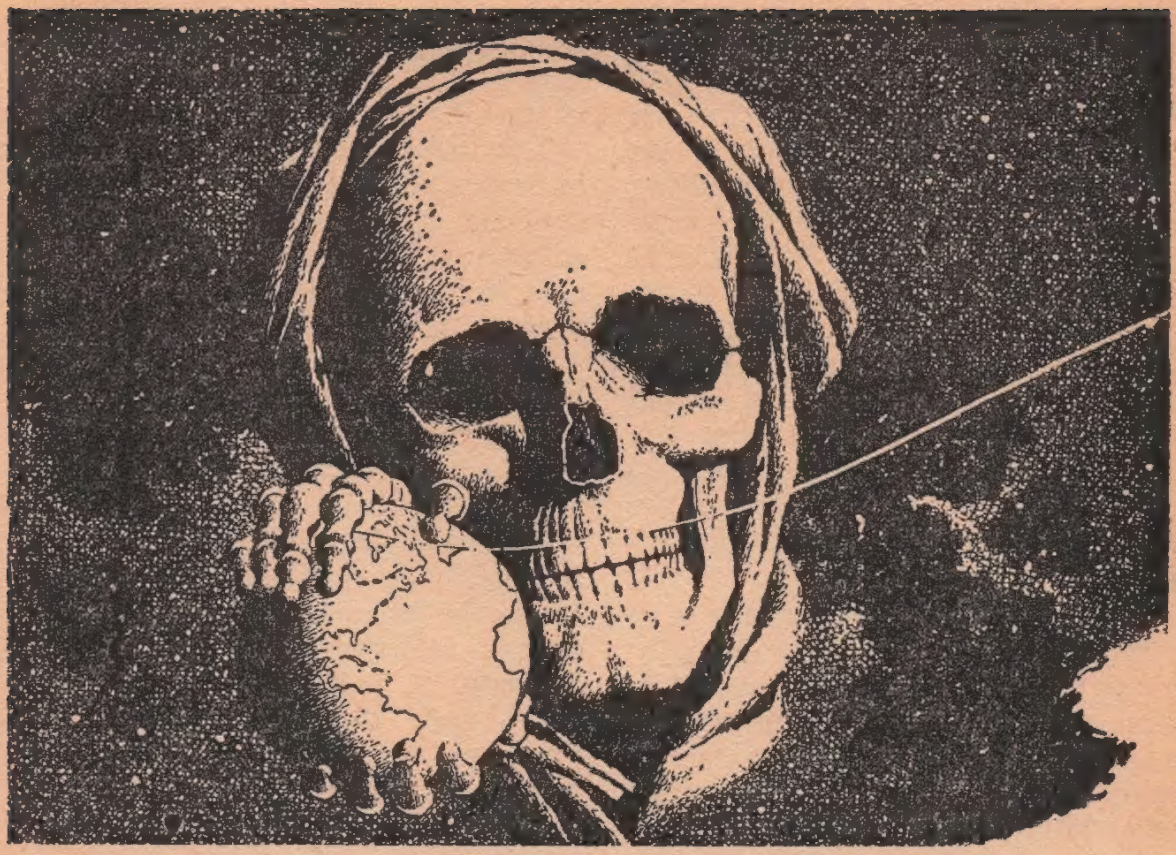
Then somehow the ability-to-learn is generated by a development that goes from the fertile ovum to the learning mind. My, would the computermen like to have *that* process worked out!

Somehow, the learning process must be wrapped up in that curious topological development that, starting with a simple spheroid, complexes steadily to produce the pentalobate structure Man. Perhaps the nature-of-mind is something that develops as a higher order topology—but certainly it develops as a continuous process, not as a miracle-without-process.

You're anxious to study the product of an alien and higher science, in order to advance more rapidly?

Go to it, friend! You've got several in your own home—the product of quite a superior science, of quite an Intelligent Entity.

THE EDITOR.



AT DEATH'S END

***It's hard**—when you're in the middle of the storm—to see that a* world *can end, and still know that* the world *hasn't come to an end!*

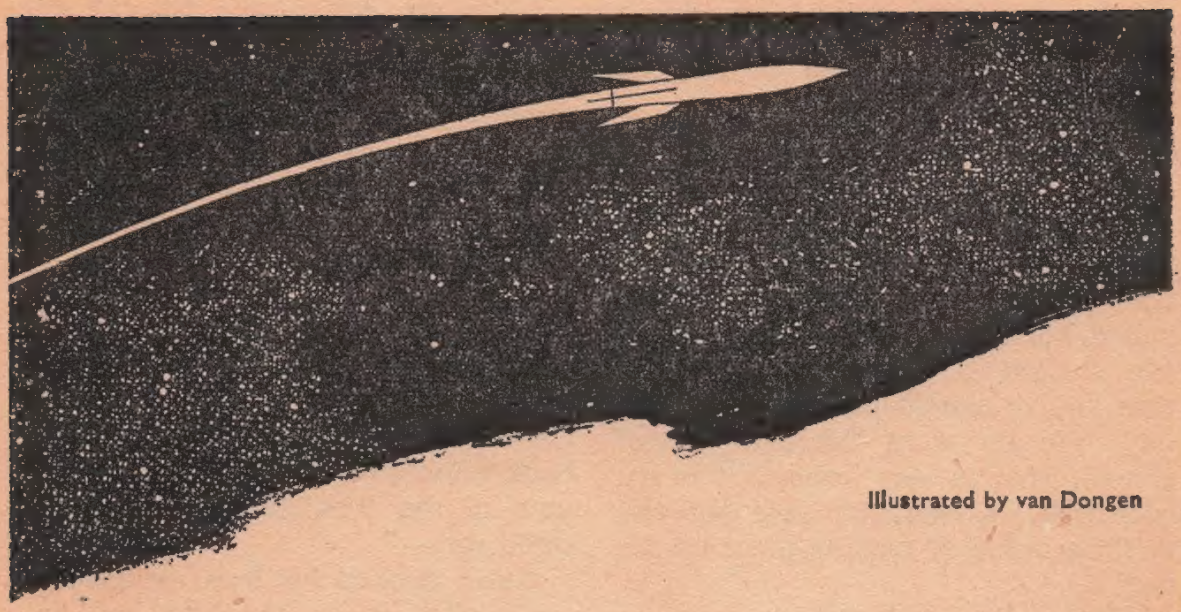
By JAMES BLISH

And death shall have no dominion.
Dead men naked they shall be one
With the man in the wind and the west moon:
When their bones are picked clean and the clean bones gone,
They shall have stars at elbow and foot . . .

Dylan Thomas

THE parade of celebrities, notorieties, and just plain brass that passed through the reception room of Jno. Pfitzner & Sons, Inc., was marvelous to behold. During the hour and a half that Colonel Paige Russell had been cooling his heels, he had seen Senator Bliss Wagoner, chairman of the Joint Congressional Committee on Space Flight; Dr. Giuseppe Corsi, president of the American Association for the Advancement of Science; D. O. MacHinery, the hereditary head of the FBI; and a number of other people whose business at a firm which made biologicals was not a proper subject for guessing games.

At the present moment, the girl at



Illustrated by van Dongen

the desk was talking softly with a seven-star general, which was a rank nearly as high as a man could rise in the army. The general was so preoccupied that he had completely failed to see Paige's salute. He was passed through swiftly. One of the two swinging doors with the glass ports in them moved outward behind the desk, and Paige caught a glimpse of a stocky, dark-haired, pleasant-faced man in a conservative grosse-pointilliste suite.

"General Horsefield, glad to see you. Come in."

The door closed, leaving Paige once more with nothing to look at but the motto written over the entrance in German black-letter: *Wider den Tod ist kein Krautlein gewachsen.* Since he did not know the language, he had already translated this by the If-only-it-were-English system, which made it come out, "The fatter toad is waxing on the kines' coleslaw." This did not seem to fit what little he knew about the eating habits of either animal, and it was certainly no fit admonition for workers in the world's largest production plant of biologicals.

Of course, Paige could always look at the receptionist—but after an hour and a half he had about plumbed the uttermost depths of that ecstasy. The girl was pretty in a way, but hardly striking even to a recently-returned spaceman. This, too, was odd now that he thought about it; a firm as large as Jno. Pfitzner & Sons, Inc., could have its pick of the glossiest of office girls.

All in all, Paige was already well past mild annoyance at all the stalling. He was, after all, here at these people's specific request, doing them a small favor for which they had asked—and soaking up good leave-time in the process. Abruptly he got up and strode to the desk.

"Excuse me, Miss, but I think you're being impolite," he said. "As a matter of fact, I'm beginning to think you people are making a fool of me. Do you want these, or don't you?"

He unbuttoned his right breast pocket and pulled out three little pliofilm packets, heat-sealed to plastic mailing tags. Each packet contained a small spoonful of dirt; the tags were addressed to Jno. Pfitzner & Sons, Inc., Brooklyn 153, WPO 249920,

Earth, and each carried ten dollar rocket-mail stamp for which Pfitzner had paid, still uncanceled.

"Colonel Russell, I agree with you," the girl said, looking up at him seriously. She looked even less glamorous than she had at a distance, but she did have a pert and interesting nose, and the current royal-purple lip shade suited her better than it did most of the current 3V novalets. "It's just that you've caught us on a very bad day. We do want the samples, of course. They're very important to us, otherwise we wouldn't have put you to the trouble of picking them up for us."

"Then why can't I give them to someone?"

"You could give them to me," the girl suggested gently. "I'll pass them along faithfully, I promise you."

Paige shook his head. "Not after this runaround. I did just what your firm asked me to do and I'm here to see the results. I picked up soils from every one of my ports of call, even when it was a nuisance to do it. Do you know where these bits of dirt came from? Ganymede, two of them—and the other's from Callisto. Now I want to see why Pfitzner wants dirt."

The girl shrugged. "I'm sure you were told why before you ever left Earth."

"Supposing I was? I know that you people get drugs out of dirt. But aren't the people who bring in the samples entitled to see how the process works? What if Pfitzner gets some new wonder-drug out of one of my samples—couldn't I have a sentence or two of explanation to pass on to my kids?"

The swinging doors bobbed open, and the affable face of the stocky man was thrust into the room.

"Dr. Abbott not here yet, Anne?" he said.

"Not yet, Mr. Gunn. I'll call you the minute he arrives."

"But you'll keep me sitting at least another ninety minutes," Paige said flatly. Gunn looked him over, starting at the colonel's eagle on his collar and stopping at the winged crescent pinned over his pocket.

"Apologies, colonel, but we're having ourselves a small crisis today," he said, smiling tentatively. "I gather you've brought us some samples from space. If you could possibly come back tomorrow, I'd be happy to give you all the time in the world. But right now—"

Gunn ducked his head in apology and pulled it in, as if he had just cuckooed 2400 and had to go somewhere and lie down until 0100. Just before the door came to rest behind him, a faint but unmistakable sound came through it.

Somewhere in the laboratories of Jno. Pfitzner & Co., Inc., a baby was crying.

Paige listened, blinking, until the sound was damped off. When he looked back down at the desk again, the expression of the girl behind it seemed distinctly warier.

"Look," he said, "I'm not asking a great favor of you. I don't want to know anything I shouldn't know. All I want to know is how you plan to process my packets of soil. It's just simple curiosity—backed up by a trip that covered a few hundred millions of miles. Am I entitled to know for my trouble, or not?"

"You are and you aren't," the girl said steadily. "We want your samples, and we'll agree that they're unusually interesting to us because they came from the Jovian system—the first such we've ever gotten. But that's no guarantee that we'll find anything useful in them."

"No?"

"No. Colonel Russell, you're not the first man to come here with soil samples, believe me. We've asked virtually every space pilot, every Believer missionary, every commercial traveler, every explorer, every foreign correspondent to scoop up soil samples for us, wherever they may go. Before we discovered ascomycin, we had to screen *one hundred thousand* soil samples, including several hundred from Mars and nearly five thousand from the Moon. And do you know where we found the organism that produces ascomycin? On a peach one of our detail men picked up from a stall in Baltimore!"

"I see the point," Paige said reluctantly. "What's ascomycin, by the way?"

The girl looked down at her desk and moved a piece of paper from here to there. "It's a new antibiotic," she said. "We'll be marketing it soon. But I could tell you the same kind of story about other such drugs. "

"I see." Paige was not quite sure he did see, however. He had heard the name of Pfitzner fall from some very unlikely lips during his many months in space. As far as he had been able to determine after he had become sensitized to the sound, about every third person on the planets was either collecting samples for the firm or knew somebody who was. The grapevine, which among spacemen was the only trusted medium of communication, had it that the company was doing important government work. That, of course, was nothing unusual in the Age of Defense, but Paige had heard enough to suspect that Pfitzner was something special—something as big, perhaps, as the historic Manhattan District and at least twice as secret.

The door opened and emitted Gunn for the third time hand-running, this time all the way.

"Not yet?" he said to the girl. "Evidently he isn't going to make it. Unfortunate. But I've some time now colonel—"

"Russell, Paige Russell, Army Space Corps."

"Thank you, Colonel Russell. If you'll accept my apologies for our preoccupation, I'll be glad to show you our little establishment. My name, by the way is, Truman Gunn, vice president in charge of export."

"I'm importing at the moment," Paige said, holding out the soil samples. Gunn took them reverently and dropped them in a pocket of his jacket. "But I'd enjoy seeing the labs."

He nodded to the girl and the doors closed between them. He was inside.

The place was at least as fascinating as he had expected it to be. Gunn showed him, first, the rooms where the incoming samples were classified and then distributed to the laboratories proper. In the first of these, a measured fraction of a sample was dropped into a ten-liter flask of sterile distilled water, swirled to distribute it evenly, and then passed through a series of dilutions. The final suspensions were then used to inoculate test-tube slants and perti plates containing a wide variety of nutrient media, which were then incubated.

" In the next lab here—Dr German isn't in at the moment, so we mustn't touch anything, but you can see through the glass quite clearly—we transfer from the plates and agar slants to a new set of media," Gunn explained. "But here each organism found in the sample has a set of cultures of its own, so that if it secretes anything into one of the media, that something won't be contaminated."

"If it does, the amount must be

very tiny," Paige said. "How do you detect it?"

"Directly, by its action. Do you see the row of plates with the white paper disks in their centers, and the four furrows in the agar radiating out from the disks? Well, each one of those furrows is a streak-inoculation of a different kind of germ, and each paper disk is impregnated with culture medium from one of the pure cultures. If all four streaks grow thriving bacterial colonies, then the medium on the paper disk contains no antibiotic against those four germs. If one or more of them fails to grow, or is retarded compared to the others, then we have hope."

In the succeeding laboratory, antibiotics which had been found by the disk test were pitted against a whole spectrum of dangerous organisms. About ninety per cent of the discoveries were eliminated here, Gunn explained, either because they were insufficiently active or because they duplicated the antibiotic spectra of already-known drugs. "What we call 'insufficiently active' varies with the circumstances, however," he said. "An antibiotic which shows *any* activity against TB or Hansen's disease is always of interest to us, even if it attacks no other germ at all."

The few antibiotics which passed their spectrum tests went on to a miniature pilot plant, where the organisms that produced them were set to work in a deep-aerated fermentation tank. From this, comparatively large amounts of the crude drug were extracted, purified, and sent to the pharmacology lab for tests on animals.

"We lose a lot of otherwise-promising antibiotics here, too," Gunn said. "Most of them turn out to be too toxic to be used in—or even on—the human body. We've had TB knocked out a thousand times in the test tube, only to find here that the antibiotic is more quickly fatal *in vivo* than is TB itself. But once we're sure the drug isn't toxic, or that its toxicity is outweighed by its therapeutic efficacy, it goes out of the plant entirely, and goes to hospitals and individual doctors for clinical evaluation. We also have a virology lab in Vermont where we test our new drugs against virus diseases—it isn't safe to operate such a lab in a large city like Brooklyn."

"It's much more elaborate than I would have imagined," Paige said. "But I can see that it's well worth the trouble. Did you work out this screening technique here?"

"Oh, my, no," Gunn said, smiling indulgently. "We may have refined it a little, but Waksman, the discoverer of streptomycin, laid down the essential procedure decades ago. We aren't even the first firm to use it on a large scale; one of our competitors did that, and found a broad-spectrum antibiotic, chlorotetracycline, with it scarcely a year after they'd begun. That's what convinced the rest of us that we'd better adopt the technique."

Farther down the corridor, a door opened. The squall of a baby came out of it, much louder than before. It was not the sustained crying of an infant who had had a year or so to practice, but the short-breathed "Ah-la, ah-la, ah-la" of a newborn child.

Paige raised his eyebrows. "Is that one of your experimental animals?" he said.

"Ha, ha," Gunn said. "We're enthusiasts in this business, colonel, but we must draw the line somewhere. No, one of our technicians has a baby-sitting problem, and so we've given her permission to bring the child to work with her, until she's worked out a better solution."

Paige had to admit that Gunn

thought fast on his feet. That story had come reeling out of him like so much ticker tape, without the slightest sign of a preliminary double-take. It was not Gunn's fault that Paige, who had been through a marriage which had lasted five years before he had taken to space, could distinguish between the cry of a baby old enough to be out of a hospital nursery and that of one only days old.

"Isn't this," Paige said, "a rather dangerous place to park an infant—with so many pathogenic germs, poisonous disinfectants, and such things all around it?"

"Oh, we take all proper precautions. I daresay our staff has a far lower yearly sickness rate than you'll find in industrial plants of comparable size, simply because we're more aware of the problem. Now if we go through this door, Colonel Russell, we'll see the final step, the main plant where we turn out drugs in quantity after they've proved themselves."

"Yes, I'd like that. Do you have ascomycin in production now?"

This time Gunn looked at him sharply and without any attempt to disguise his interest. "No," he said, "that's still out on clinical trial. May I ask you, Colonel Russell, just how you happened to—"

The question, which Paige realized belatedly would have been rather sticky to answer, never did get all the way asked. Over Truman Gunn's head, a squawk-box said, "Mr. Gunn, Dr. Abbott has just arrived."

Gunn turned away from the door that led out to the main plant with just the proper modicum of polite regret. "There's my man," he said. "I'm afraid I'm going to have to cut this tour short, Colonel Russell. You may have seen what a collection of important people we have in the plant today; we've been waiting only for Dr. Abbott to begin a very important meeting. If you'll oblige me—"

Paige could say nothing but, "Certainly." After what seemed only a few seconds later, Gunn deposited him smoothly in the reception room where he had started.

"Did you see what you wanted to see?" the receptionist said.

"I think so," Paige said thoughtfully. "Except that what I wanted to see sort of changed in mid-flight. Miss Anne, I have a petition to put before you. Would you be kind enough to have dinner with me this evening?"

"No," the girl said. "I've seen quite a few spacemen, Colonel Russell, and I'm no longer impressed. Furthermore, I shan't tell you anything you haven't heard from Mr. Gunn, so there's no need for you to spend your money or your leave-time on me. Good-by."

"Not so fast," Paige said. "I mean business—or, if you like, I mean to make trouble. If you've met spacemen before, you know that they like to be independent—not much like the conformists who never leave the ground. I'm not after your maidenly laughter, either. I'm after information."

"Not interested," the girl said.

"McCarthy is here," Paige said quietly. "So is Senator Wagoner, and some other people who have influence. Suppose I should collar any one of those people and accuse Pfitzner of conducting human vivisection?"

That told: Paige could see the girl's knuckles whitening. "You don't know what you're talking about," she said.

"That's my complaint. And I take it seriously. There were some things Mr. Gunn wasn't able to conceal from me, though he tried very hard. Now am I going to put my suspicions through channels—and get Pfitzner investigated—or are you going to be

sociable, over a fine flounder broiled in paprika butter?"

The look she gave him back was one of pure hatred. She seemed able to muster no other answer. The expression did not at all suit her; as a matter of fact, she looked less like someone he would want to date than any other girl he could remember. Why *should* he spend his money or his leave-time on her? There were, after all, about five millions of surplus women in the United States by the Census of 2000, and at least 4,999,950 of them must be prettier and less recalcitrant than this one.

"All right," she said abruptly. "Your natural charm has swept me off my feet, colonel. For the record, there's no other reason for my acceptance. It would be even funnier to call your bluff and see how far you'd get with that vivisection tale, but I don't care to see the company tied up in a personal joke."

"Good enough," Paige said, uncomfortably aware that his bluff in fact *had* been called. "Suppose I pick you up—"

He broke off, suddenly noticing that voices were rising behind the double doors. An instant later, General Horsefield bulled into the reception room, closely followed by Gunn.

"I want it clearly understood, once and for all," Horsefield was rumbling, "that this entire project is going to wind up under military control unless we can show results before it's time to ask for a new appropriation. There's still a lot going on here that the Pentagon will regard as piddling inefficiency and highbrow theorizing. And if that's what the Pentagon reports, you know what the Treasury Department will do—or Congress will do it for them. We're going to have to cut back. Gunn. Understand? Cut right back to basics!"

"General, we're as far back to basics as we possibly can get," Truman Gunn said, placatingly enough, but with considerable firmness as well. "We're not going to put a gram of that drug into production until we're satisfied with it on all counts."

"You know, I'm on your side," Horsefield said, his voice becoming somewhat less threatening. "But this is a war we're fighting, whether the public understands it or not. And on as sensitive a matter as these death-dopes, we can't afford—"

Gunn, who had spotted Paige belatedly at the conclusion of his own speech, had been signaling Horsefield ever since with his eyebrows, and suddenly it took. The general swung and glared at Paige, who, since he was uncovered now, was relieved of the necessity for saluting. Despite the sudden freezing silence, it was evident that Gunn was trying to retain in his manner toward Paige some shreds of professional cordiality — a courtesy which Paige was not too sure he merited, considering the course his conversation with the girl had taken.

As for Horsefield, he relegated Paige to the ghetto of "unauthorized persons" with a single look. With a mumbled " . . . At eight, then," to the girl, Paige sidled ingloriously out.

He was, he reflected later before his shaving mirror, subjecting himself to an extraordinary series of small humiliations to get closer to a matter which was none of his business. Worse: it was obviously Top Secret, which made it deadly dangerous for everyone authorized to know about it, let alone for rank snoopers.

And why was he taking the risk? He didn't even know the substance of the matter. To all outside eyes it was simply another piece of research in antibiotics, and a rather routinized research project at that. Why should a

spaceman like Paige find himself flying so closely to the candle already?

He wiped the depilatory cream off his face into a paper towel, and saw his own eyes looking back at him from the mirror. The image gave him back no answer.

II.

The girl—whose full name, Paige found, was Anne Abbott—looked moderately acceptable in her summer suit, on the left lapel of which she wore a model of the tetracycline molecule with the atoms picked out in tiny synthetic gems. But she was even less inclined to talk when he picked her up than she had been in Pfitzner's reception room. Paige himself had never been expert in making small talk, and in the face of her obvious, continuing resentment his parched spring of social invention went underground completely.

Five minutes later, all talk became impossible, anyhow. The route to the restaurant Paige had chosen lay across Foley Square, where there turned out to be a Believer meeting going. The caddy Paige had hired—at nearly a quarter of his leave-pay, for commercial kerosene-fueled taxis were strictly a rich man's occasional luxury—was bogged down almost at once in the groaning, swaying crowd.

The main noise came from the big plastic proscenium, where one of the lay preachers was exhorting the crowd in a voice so heavily amplified as to be nearly unintelligible. Believers with portable tape phonographs, bags of tracts and magazines, sandwich-boards lettered with fluorescent inks, confessions for sinners to sign, and green baize pokes for collections were well scattered among the pedestrians, and the streets were crossed about every fifty feet with the straight black snakes of compressed-air triggers.

As the caddy pulled up for the second time, a nozzle was thrust into the rear window and a stream of iridescent bubbles poured across the back seat directly under Paige's nose. As each bubble burst, there was a wave of perfume—evidently it was "Celestial Joy" the Believers were using this year—and a sweet voice said: "*Brothers and Sisters Have You Seen the Light?*"

Paige fought at the bubbles with futile windmillings, while Anne Abbott leaned back against the cushions of the caddy and watched him, with a faint smile of contemptuous amusement. The last bubble contained no word, but only an overpowering burst of odor. Despite herself, the girl's smile deepened: the perfume, in addition to being powerfully euphoric, was slightly aphrodisiac as well. This year, apparently, the Believers were readier than ever to use any means to hand.

The driver lurched the caddy ahead. Then, before Paige could begin to grasp what was happening, the car stopped, the door next to the wheel was swung open, and four spidery, many-fingered arms plucked the driver neatly from his seat and deposited him on his knees on the asphalt outside.

"SHAME! SHAME!" the popai-robot thundered. "YOUR SINS HAVE FOUND YOU OUT! REPENT, AND FIND FORGIVENESS!" A thin glass globe of some gas, evidently a narco-synthetic, broke beside the car, and not only the unfortunate chauffeur but also the part of the crowd—mostly women, as usual—which had begun to collect about him began to weep convulsively. "REPENT!" the robot intoned, over a sneaked-in choir now singing "Ah-ah-ah-h-h-h" somewhere in the warm

evening air. "FOR THE TIME IS AT HAND!"

Paige, astonished to find himself choking with sourceless, maudlin self-pity, flung himself out of the caddy looking for a nose to break, but there were abruptly no live Believers in sight. The members of the order, all of whom were charged with spreading the good work by whatever means seemed good to them, had learned decades ago that their proselytizing was often resented, and had substituted technology for personal salesmanship wherever possible.

Their machines, too, had been forced to learn. The point-of-purchase robot retreated as Paige bore down upon it; the thing had been conditioned against getting itself broken.

The caddy's driver, rescued, blew his nose resentfully and started the car again. The wordless choir, with its eternal bridge-passage straight out of Dmitri Tiomkin, diminished behind them, and the voice of the lay preacher came roaring back through to them over the fading music.

"I say to you," the loud-speaker was moaning unctuously, like a lady hippopotamus reading A. E. Housman "the world and the things which are the world's come to an end and a quick end. In his overweening pride, man has sought even to wrest the stars from their courses, but the stars are not man's, and he shall rue that day. Ah, vanity of vanities, all is vanity! (Preacher V: 796.) Even on mighty Jove man has dared to erect a great Bridge, as once in Babel he sought to build a tower to heaven. But this Bridge, too, is vanity, it is vicious pride and defiance, and it, too, shall fall. Pull down thy vanity, I say pull down! (Ezra LXXXI: 99.) Let there be an end to pride, and there shall be peace. Let there be love, and there shall be understanding. I say to you—"

At this point, the Believers' over-enthusiastic booby-trapping of the square cut off whatever the preacher was going to say next, as far as the occupants of the caddy were concerned. The car passed over another trigger, and there was a blinding, rose-colored flash. When Paige could see again, the car seemed to be floating in midair, and there were actual angels flapping solemnly around it. The *vox humana* of a Hammond organ sobbed among the clouds.

Paige supposed that the Believers had managed to crystallize temporarily, perhaps with a supersonic pulse, the glass of the windows, which he had rolled up to prevent another intromission of bubbles, and to project a 3V tape against the glass crystals with polarized ultraviolet light. The random distribution of fluorescent trace compounds in ordinary window glass would account for the odd way the "angels" changed color as they moved.

Understanding the vision's probable *modus operandi* left Paige no less furious at the new delay, but luckily the thing turned out to be a trick left over from last year's Meeting, for which the caddy was prepared. The driver touched something on the dash and the saccharine scene vanished, hymns and all. The car lunged abruptly through an opening in the crowd, and a moment later the Square was behind them.

"*Whew!*" Paige said, leaning back at last. "Now I understand why taxi depots have vending machines for trip-insurance policies. The Believers weren't much in evidence the last time I was on Earth."

"Every tenth person you meet is a Believer now," Anne said. "And eight of the other nine claim that they've

given up religion as a bad job. While you're caught in the middle of one of those meetings, though, it's hard to believe the complaints you read about our times—that people have no faith and so on."

"I don't find it so," Paige said reflectively. This certainly did not strike him as light social conversation, but since it was instead a kind of talk he much more enjoyed—talk which was about something—he could only be delighted that the ice was broken. "I've no religion of my own, but I think that when the experts talk about 'faith' they mean something different than the shouting kind, the kind the Believers have. Shouting religions always strike me as essentially like pep-meetings among salesmen; their ceremonies and their manners are so aggressive because they don't really believe the code themselves. Real faith is so much a part of the world you live in that you seldom notice it, and it isn't always religious in the formal sense. Mathematics is based on faith, for instance, for those who know it."

"I should have said that it was based on the antithesis of faith," Anne said, turning a little colder. "Have you had any experience in the field, colonel?"

"Some," he said, without rancor. "I'd never have been allowed to pilot a ship outside the orbit of the Moon without knowing tensors, and if I expect to get my next promotion, I'm going to have to know spinor calculus as well—which I do."

"Oh," the girl said. She sounded faintly dashed. "Go on; I'm sorry I interrupted."

"You were right to interrupt; I made my point badly. I meant to say that the mathematician's belief that there is some relationship between math and the real world is a faith;

it can't be proven, but he feels it very strongly. For that matter, the totally irreligious man's belief that there even *is* a real world, other than what his sense-impressions show him, can't be proven; John Doe and the most brilliant physicist both have to take that on faith. In the same way, John Doe used to feel that the basic religions of the West had some relationship to the real world which was valid even though it couldn't be proven—and that includes Communism, which was born in the West, after all. John Doe doesn't feel that way any more—and by my guess, neither do the Believers, or they wouldn't be shouting so loud. In that sense, there's not much faith lying around loose these days anywhere, as far as I can see. None for me to pick up, that much I've found out the hard way."

"Har y'are," the chauffeur said.

Paige helped the girl out of the car, trying not to notice how much fare he had had to pay, and the two were shown to a table in the restaurant. Anne was silent again for a while after they were seated; Paige had about decided that she had chosen to freeze up once more, and to wonder if he could arrange to have the place invaded by Believers to start the conversation again, when she said:

"You seem to have been thinking about faith quite a bit. You talk as though the problem meant something to you. Could you tell me why?"

"I'd be glad to try," he said slowly. "The standard answer would be that while you're out in space you have lots of time to think—but people use thinking-time differently. I suppose I've been looking for some frame of reference that could be mine ever since I was four, when my father and mother split up. There was a court battle over custody that lasted for nearly five years.

"I joined the Army when I was seventeen, and it didn't take me very long to find out that the Army is no substitute for a family, let alone a church. Then I volunteered for space service. That was no church either. The Army got jurisdiction over space travel when the whole field was just a baby, because it had a long tradition of grafting off land-grants, and it didn't want the Navy or the Air Force to grab off the gravy from any such grants that might be made on the planets. I spent more time helping the Army space-travel department fight unification with the space arms of the other services than I did doing real work in space, because that was what I was ordered to do—but it didn't help me to think of space as the ultimate cathedral.

"Somewhere along in there, I got married and we had one son. Two years later, the marriage was annulled. That sounds funny, I know, but the circumstances were unusual.

"When Pfitzner approached me and asked me to pick up soil samples for them, I suppose I saw another church with which I could identify myself—something humanitarian, long-range, impersonal. And when I found this afternoon that the new church wasn't going to welcome the convert with glad cries—well, the result is that I'm now weeping on your shoulder." He smiled. "That's hardly flattering, I know. But you've already helped me to talk myself into a spot where the only next step is to apologize, which I hereby do. I hope you'll accept it."

"I think I will," she said, and then, tentatively, she smiled back. The result made him tingle as though the air-pressure had dropped suddenly by five pounds per square inch. Anne Abbott was one of those exceedingly rare plain girls whose smiles completely transform them, as abruptly

as the bursting of a star shell. When she wore her normal, rather sullen expression, no one would ever notice her — but a man who had seen her smile might well be willing to kill himself working to make her smile again, as often as possible. A woman who was beautiful all the time, Paige thought, probably never could know the devotion Anne Abbott would be given, when she found that man.

"Thank you," Paige said, rather inadequately. "Let's order, and then I'd like to hear you talk. I dumped the Story of My Life into your lap rather early in the game, I'm afraid."

"You order," she said. "You talked about sea food this afternoon, so you must know the menu here—and you handed me out of the caddy so nicely that I'd like to preserve the illusion."

"Illusion?"

"Don't make me explain," she said, coloring faintly. "But . . . well, the illusion of there being one or two cavaliers in the world still. Since you haven't been a surplus woman on a planet full of lazy males, you wouldn't understand the value of a small courtesy or two."

Paige's surprised shout of laughter made heads turn all over the restaurant. He throttled it hurriedly, afraid that it would embarrass the girl, but she was smiling again, making him feel instead as though he had just had three whiskeys in quick succession.

"That's a quick transformation for me," he said. "This afternoon I was a blackmailer, and by my own intention, too. Very well, then, let's have the flounder; it's a speciality of the house. I had visions of it, while I was on Ganymede munching my concentrates."

"I think you had the right idea about Pfitzner," Anne said slowly when the waiter had gone. "I can't tell you any secrets about it, but maybe I can tell you some bits of common knowledge that you evidently don't know. The project the plant is working on now seems to me to fit your description exactly: it's humanitarian, impersonal, and just about as long-range as any project I can imagine. I feel rather religious about it, in your sense. It's something to tie to, and it's better for me than being a Believer. And I think you could understand why I feel that way —better than either Tru Gunn or I thought you could."

It was his turn to be embarrassed. He covered by dosing his blue points with Worcestershire until they flinched visibly. "I'd like to know."

"It goes like this," she said. "In between 1940 and 1960, a big change came in in Western medicine. Before 1940—in the early part of the century — the infectious diseases were major killers. By 1960 they were all but knocked out of the running. The change started with the sulfa drugs; then came Fleming and Florey and mass production of penicillin during World War II. After the war we found a whole arsenal of new drugs against tuberculosis, which had really never been treated successfully before — streptomycin, PAS, isoniazid, viomycin, and so on, right up to Bloch's isolation of the TB toxins and the development of the metabolic blocking agents. Then came the broad-spectrum antibiotics, like terramycin, which attacked some virus diseases, protozoan diseases, even worm diseases; that gave us a huge clue to a whole set of tough problems. The last major infectious disease — bilharzia, or schistosomiasis — was reduced to the status of a nuisance by 1955."

"But we still have infectious diseases," Paige objected.

"Of course we do," the girl said, the

little atom-points in her brooch picking up the candlelight as she leaned forward. "No drug ever wipes out a disease, because it's impossible to kill all the dangerous organisms in the world just by treating the patients they invade. But you can reduce the danger. In the 1950s, for instance, malaria was the world's greatest killer. Now it's as rare as diphtheria. We still have both diseases with us—but how long has it been since you heard of a case of either?"

"You're asking the wrong man—germ diseases aren't common on space vessels. But you win the point, all the same. Go on. What happened then?"

"Something kind of ominous. Life insurance companies, and other people who kept records, began to be alarmed at the way the degenerative diseases were coming to the fore. Those are such ailments as hardening of the arteries, coronary heart disease, the rheumatic diseases, and almost all the many forms of cancer — diseases where one or another body mechanism suddenly goes haywire, without any visible cause."

"Isn't old age the cause?"

"*No*," the girl said forcefully. "Old age is just the *age*; it's not a thing in itself, it's just the time of life when most degenerative diseases strike. Some of them prefer children — leukemia, for instance. When the actuaries first began to notice that the degenerative diseases were on the rise, they thought that it was just a sort of side-effect of the decline of the infectious diseases. They thought that cancer was increasing because more people were living long enough to come down with it. Also, the reporting of the degenerative diseases was improving, and so part of the rise in incidence really was an illusion — it just meant that more cases were being detected than before.

"But that wasn't all there was to it. Lung cancer and stomach cancer in particular continued to creep up the statistical tables, far beyond the point which could have been accounted for by better reporting, or by the increase in the average life span, either. Then the same thing took place in malignant hypertension, in Parkinsonism and other failures of the central nervous system, in muscular dystrophy, in gout and rheumatism, and so on, and so on. It began to look very much as though we'd exchanged a devil we knew for a devil we didn't.

"So there was quite a long search for a possible infectious origin for each of the degenerative diseases. Because some animal tumors are caused by viruses, like poultry sarcoma, for instance, a lot of people set to work hunting like mad for all kinds of cancer viruses. There was a concerted attempt to implicate a group called the pleuropneumonia-like organisms as cause of the arthritic diseases. The vascular diseases, like hypertension and thrombosis, were blamed on everything from your diet to your grandmother.

"And it all came to very little. Oh, we did find that *some* viruses did cause *some* types of cancer. The PPLO group did cause *a* type of arthritis, too, but only the one associated with a social disease called essential urethritis. But for the most part, we found out just what we had known before — that the degenerative diseases weren't infectious. And we already knew that that was a dead end.

"About there was where Pfitzner was brought into the picture. The NHS, the National Health Service, got alarmed enough about the rising incidence-curves to call the first really intensive world congress on the degenerative diseases. The United States paid part of the bill because the armed services were getting nervous about the

rising rate of draft rejections they were being forced to return. It doesn't seem unusual now that ten per cent of a given class of men in their twenties should be rejected for what we still call 'diseases of old age,' but in those days it was shocking."

"It shocks me right now," Paige admitted.

"Only because it's new to you, I'm afraid. It's old stuff to the armed services now. Anyhow, the result of the congress was that the United States Department of Health, Welfare and Security somehow got a billion-dollar appropriation for a real mass attack on the degenerative diseases. In case you drop zeroes as easily as I do, that was about half what had been spent to produce the first fission bomb. Since then, the appropriation has been renewed once, and it's due for renewal again now.

"Pfitzner holds the major contract on that project, and we're well enough staffed and equipped to handle it so that we've had to do very little subcontracting. We simply share the appropriation with three other producers of biologicals, one of whom is a producer only and has almost no hand in the research. That's one reason why you saw so many government people on our necks this afternoon.

"The other reason is even simpler, now that you have the background. *We've just found what we think may be a major key to the whole problem.*"

"Wow," Paige said, inelegantly but *affetuoso*.

"Or zowie, or biff-bam-krunk," the girl agreed calmly. "But so far the thing's held up. It's passed every test. If it keeps up that performance, Pfitzner will get the whole of the new appropriation—and if it doesn't, there may not be any appropriation at all, not only for Pfitzner, but for the other firms that have been helping on the project.

"The whole question of whether or not we lick the degenerative diseases hangs on those two things: the validity of the solution we've found, and the money. If one goes, the other goes. And we'll have to tell Horsefield and MacHinery and the others what we've found some time this month, because the old appropriation lapses after that."

The girl leaned back and seemed to notice for the first time that she had finished her dinner. "And that," she said, pushing regretfully at the sprig of parsley with her fork, "isn't exactly public knowledge yet! I think I'd better shut up."

"Thank you," Paige said gravely. "It's obviously more than I deserve to know."

"Well," Anne said, "you can tell *me* something, if you will. It's about this Bridge that's being built on Jupiter. Is it worth all the money they're pouring into it? Nobody seems to be able to explain what it's good for. And now there's talk that another Bridge'll be started on Saturn, when this one's finished!"

"You needn't worry," Paige said. "Understand, I've no official connection with the Bridge gang or their project, so I haven't any inside information. I do have some public knowledge, just like yours—meaning knowledge that anyone can have, if he has the training to know where to look for it. I can tell you this much: there's not the faintest chance that another Bridge will even be started on Saturn, not even on a drawing-board. Furthermore, the present Bridge on Jupiter isn't ever going to be finished so there'll never come a time when a new one could be thought about—except by video commentators and other wonder-mongers."

"I don't understand yet," Anne said. "Is the Bridge gang just going to go on and on building it forever?"

"Oh no. The Bridge is only a research project, designed to answer some questions—just what questions, nobody's bothered to tell me, and I've been careful not to ask; you can even see D. O. MacHinery's face in the constellations if you look carefully enough. But this much I know: the conditions of the research demand the use of the largest planet in the system. That's Jupiter, so it would be senseless to build another Bridge on a smaller planet, like Saturn. The Bridge gang will keep the present structure going until they've found out what they want to know. Then the project almost surely will be discontinued — not because the Bridge is 'finished,' but because it will have served its purpose."

"I suppose I'm showing my ignorance," Anne said, "but it sounds idiotic to me. All those millions and millions of dollars—that *we* could be saving lives with!"

"If the choice were mine," Paige agreed, "I'd give you the money before I'd award it to Charity Dillon and his crew — but then I know as little about the Bridge as you do, so perhaps it's just as well that I can't route the check. Is it my turn to ask a question? I still have a small one."

"Your witness," Anne said, smiling her altogether lovely smile.

"This afternoon, while I was in the labs, I twice heard a baby crying—and I think it was actually two different babies. I asked your Mr. Gunn about it, and he told me an obvious fairy story." He paused. Anne's eyes had already begun to glitter.

"You're on dangerous ground, Colonel Russell," she said.

"I can tell. But I mean to ask my question anyhow. When I pulled my absurd vivisection threat on you later, I was out-and-out flabbergasted that it worked, but it set me to thinking. Can you explain—and if so, would you?"

She considered it, warily. At last she said, "I suppose I've forgiven you, more or less. Anyhow, I'll answer. It's very simple: the babies *are* being used as experimental animals. We have a pipeline to the local foundling home. It's all thoroughly illegal, and had you actually brought charges of human vivisection against us, you could have made them stick."

His coffee cup clattered into its saucer. "Anne, isn't it dangerous to make such a joke these days—especially with a man you've known only half a day? Or are you trying to startle me into admitting I'm a stoolie?"

"I'm not joking and I don't think you're a stoolie," she said calmly. "What I said was perfectly true . . . oh, I souped up the way I put it just a little, maybe because I haven't *entirely* forgiven you for that bit of successful blackmail, and I wanted to see you jump. But it's true."

"But Anne—why?"

"Look, Paige," she said. "It was fifty years ago that we found that if we added minute amounts of certain antibiotics, really just traces, to animal feeds, the addition brought the critters to market months ahead of normally-fed animals. It worked for poultry, piglets, calves, mink cubs, a whole spectrum of animals. For that matter, it even provokes growth spurts in plants under special conditions. It was logical to suspect that it might work in newborn humans, too."

"And you're trying that?" Paige leaned back and poured himself another glass of New York Rhine. "I'd say you souped up your revelation quite a bit, all right."

"Don't be so ready to accept the obvious, and listen to me. We are *not*

doing that. It was done decades ago, regularly and above the board, by students of Paul Gyorgy and half a hundred other nutrition experts. Those people used only very widely known and tested antibiotics, drugs that had already been used on literally millions of farm animals, dosages worked out to the mg./kg., and so on. But this particular growth-stimulating effect of antibiotics happens to be a major clue to whether or not a given drug was the kind of biological activity *we* want —and we have to know whether or not it shows that activity *in human beings*. So we screen new drugs on the kids as fast as they're found and pass certain other tests. We have to."

"I see," Paige said. "I see."

"The children are 'volunteered' by the foundling home, and we could make a show of legality if it came to a court fight," the girl said. "The precedent was established when Pearl River Labs used children of its own workers to test its polio vaccine—which worked, by the way. But it isn't the legality of it that's important. It's the question of how soon and how thoroughly we're going to lick the degenerative diseases."

"You seem to be defending it to me," Paige said slowly, "as if you cared what I thought about it. So I'll tell you what I think: it seems mighty cold-blooded to me. It's the kind of thing of which ugly myths are made. If ten years from now there's a pogrom on scientists because people think they eat babies, I'll know why."

"Nonsense," Anne said. "It takes centuries to build up that kind of a myth. You're over-reacting."

"On the contrary. I'm being as honest with you as you were with me. I'm astonished and somewhat repelled by what you've told me; that's all."

The girl, her lips slightly thinned, dipped and dried her fingertips and began to draw on her gloves. "Then we'll say no more about it," she said. "I think we'd better leave now."

"Certainly, as soon as I pay the check. Which reminds me: Do you have any interest in Pfitzner, Anne—a personal interest, I mean?"

"No. No more interest than any human being with a moment's understanding of the implications would have. And I think that's a rather ugly sort of question."

"I thought you might take it that way, but I really wasn't accusing you of being a profiteer. I just wondered whether or not you were related to the Dr. Abbott that Gunn and the rest were waiting for this afternoon."

"Abbott's a common enough name," she said, opening her handbag and scrutinizing herself in the mirror pasted inside its lid.

"Sure. Still, *some* Abbotts are related. And it seems to make sense."

"Let's hear you do that; I'd be interested."

"All right," he said, beginning to become angry himself. "The receptionist at Pfitzner, ideally, should know exactly what is going on at all times, so as to be able to assess accurately the intentions of every visitor—just as you did with me. But at the same time, she has to be an absolutely flawless security risk or otherwise she can't be trusted with enough knowledge to be that kind of a receptionist. The best way to make sure of the security angle is to hire someone with a blood tie to another person on the project; that adds up to *two* people who are being careful. An old Soviet form of blackmail, as I recall.

"That's theory. There's fact, too. You certainly explained the Pfitzner project to me this evening from a broad base of knowledge that nobody could expect to find in an ordinary

receptionist. On top of that, you took policy risks that, properly, only a high officer of Pfitzner should be empowered to take. I conclude that you are not *only* a receptionist; your name is Abbott; and . . . there we have it, it seems to me."

"Do we?" the girl said, standing abruptly in a white fury. "Not quite! Also, I'm not pretty, and a receptionist for a firm as big as Pfitzner is usually striking. Go ahead, complete the list! Tell the whole truth!"

"How can I?" Paige said, rising also and looking squarely at her, his fingers closing slowly. "If I told you honestly just what I think of your looks—and I will, I think the most beautiful woman in the world would bathe every day in nitric acid to duplicate your smile—you'd hate me more for mocking you. Now you tell me the rest of the truth. You *are* related to Dr. Abbott."

"Patly enough," the girl said, each word cut out of smoking-dry ice, "Dr. Abbott is my father. And I insist upon being allowed to go home now, Colonel Russell. Not ten seconds from now, but *now*."

III.

It took Paige about the same mandatory ten seconds, during breakfast of the next day in his snuggery at the Spaceman's Haven, to decide that he was going to go back to the Pfitzner plant and apologize. He didn't quite understand why the date had ended as catastrophically as it had, but of one thing he was nearly certain; the fiasco had had something to do with his space-rusty manners, and if it were to be mended, he had to be the one to tool up for it.

And now that he came to think of it over his cold egg, it seemed obvious in essence. By his last line of ques-

tioning, Paige had broken the delicate shell of the evening and spilled the contents all over the restaurant table. He had left the more or less safe womb of technicalities, and had begun, by implication at least, to call Anne's ethics into question—first by making clear his first reaction to the business about the experimental infants, and then by pressing home her irregular marriage to her firm.

In this world called Earth of disintegrating faiths, one didn't call personal ethical codes into question without getting into trouble. Such scars, where they could be found at all, obviously had cost their adherents too much pain to be open for any new probing. Faith had once been self-evident; now it was desperate. Those who still had it—or had made it, chunk by fragment by shard—wanted nothing but to be allowed to hold it.

As for why he wanted to set matters right with Anne Abbott, Paige was less clear. His leave was passing him by rapidly, and thus far he had done little more than stroll while it passed—especially if he measured it against the desperate meter-stick established by his last two leaves, the two after his marriage had shattered and he had been alone again. After the present leave was over, there was a good chance that he would be assigned to the Persephone station, which was now about finished and which had no competitors for the title of the most forsaken outpost of the solar system. None, at least, until somebody should discover an eleventh planet.

Nevertheless, he was going to go out to the Pfitzner plant again, out to scenic Brooklyn, to revel among research scientists, business executives, government brass, and a frozen-voiced girl with a figure like an ironing-board, to kick up his heels on a reception-room rug in the sight of gay steel engravings of the Founders, cheered on by a motto which might or might not be Dionysiac, if he could only read it. Great. Just great. If he played his cards right, he could go on duty at Persephone station with fine memories: perhaps the vice president in charge of Export would let Paige call him "Tru," or maybe even "Bubbles."

Maybe it was a matter of religion, after all. Like everyone else in the world, Paige thought, he was still looking for something bigger than himself, bigger than family, Army, marriage, fatherhood, space itself, or the pub-crawls and tyranically meaningless sexual spasms of a spaceman's leave. Quite obviously the project at Pfitzner, with its air of mystery and selflessness, had touched that very vulnerable nerve in him once more. Anne Abbott's own dedication was merely the touchstone, the key—No, he hadn't the right word for it yet, but her feeling somehow fitted into an empty, jagged-edged blemish in his own soul like . . . like—yes, that was it: like a jigsaw-puzzle piece.

And besides, he wanted to see that sunburst smile again.

Because of the way her desk was placed, she was the first thing he saw as he came into Pfitzner's reception room. Her expression was even stranger than he had expected, and she seemed to be making some kind of covert gesture, as though she were flicking dust off the top of her desk toward him with the tips of all her fingers. He took several slower and slower steps into the room and stopped, finally baffled.

Someone rose from a chair which he had not been able to see from the door, and quartered down on him. The pad of the steps on the carpet and the odd crouch of the shape in

the corner of Paige's eye were unpleasantly stealthy. Paige turned, unconsciously closing his hands.

"Haven't we seen this officer before, Miss Abbott? What's his business here —or has he any?"

The man in the eager semi-crouch was D. O. MacHinery.

Like his unforgettable grandfather, D. O. MacHinery was a heavy-faced man who seemed always in need of a shave. Though he would have been easy to dismiss on first glance as a not very bright truck-driver, MacHinery was as full of cunning as a wolverine, and he had managed times without number to land on his feet regardless of what political disasters had been planned for him. And he was, as Paige was now discovering, the man for whom the metaphor "gimlet-eyed" had all unknowingly been invented.

"Well, Miss Abbott?"

"Colonel Russell was here yesterday," Anne said. "You may have seen him then."

The swinging doors opened and Horsefield and Gunn came in. MacHinery paid no attention to them. He said, "What's your name, soldier?"

"I'm a spaceman," Paige said stiffly. "Colonel Paige Russell, Army Space Corps."

"What are you doing here?"

"I'm on leave."

"Will you answer the question?" MacHinery said. He was, Paige noticed, not looking at Paige at all, but over his shoulder, as if he were actually paying no attention to the conversation at all. "What are you doing in the Pfitzner plant?"

"I happen to be in love with Miss Abbott," Paige said sharply, to his own black and utter astonishment. "I came here to see her."

Anne straightened as if a curtain rod had been driven up her spine; even Gunn's mouth sagged slightly to one side. MacHinery, however, shot one quick look at Anne and his eyes seemed to turn into bottle-glass.

"I will put the question another way, so that there'll be no excuse for evading it," he said. "What is your *business* at Pfitzner, soldier?"

Paige tried to pick his next words carefully. Actually it would hardly matter what he said once MacHinery developed an interest in him; an accusation from the FBI had nearly the force of law. Everything depended upon so conducting oneself as to be of no interest to MacHinery to begin with—an exercise at which, fortunately up to now, Paige had had no more practice than any other spaceman, He said: "I brought in some soil samples from Ganymede. Pfitzner asked me to do it, as part of their research program."

"And you brought these samples in yesterday, you told me."

"No, I didn't tell you, but as a matter of fact I did bring them in yesterday."

"And you're still bringing them in today, I see." MacHinery jerked his chin over his shoulder toward Horsefield, whose face had frozen into complete tetany as soon as he had realized what was going on. "What about this, Horsefield? This one of your men you haven't told me about?"

"No," Horsefield said, but putting a sort of a question mark into the way he spoke the word, as though he did not mean to deny anything which he might later be expected to affirm. "Saw the man yesterday, I think. For the first time, to the best of my knowledge."

"I see. Would you say, general, that this man is no part of the Army's assigned complement on the project?"

"I can't say that for sure," Horsefield said, his voice sounding more

positive now that he was voicing a doubt. "I'd have to consult my T.O. He's not part of my staff, though—doesn't claim that he is, does he?"

"Gunn, what about this man? Did you people take him on without checking with me? Does he have security clearance?"

"Well, we did in a way, but he didn't need to be cleared," Gunn said. "He's just a field collector, hasn't any real part in the research work, no official connection. These field people are all volunteers; you know that."

MacHinery's brows were drawing closer and closer together. With only a few more of these questions, Paige knew even from the few newspapers which reached him in space, he would have material enough for an arrest and a sensation—the kind of arrest which would pillory Pfitzner, destroy every civilian working for Pfitzner, trigger a long chain of courts-martial among the military assignees, ruin the politicians who had sponsored the research, and thicken MacHinery's scrapbook of headlines at least three inches. That last outcome was the only one in which MacHinery was really interested; that the project itself would die was a side-effect which, though nearly inevitable, could hardly have interested him less.

"Excuse me, Mr. Gunn," Anne said quietly. "I don't think you're quite as familiar with Colonel Russell's status as I am. He's just come in from deep space, and his security record has been in the 'Clean and Routine' file for years; he's not one of our ordinary field collectors."

"Ah," Gunn said. "I'd forgotten, but that's quite true." Since it was both true and perfectly irrelevant, Paige could not understand why Gunn was quite so hearty about agreeing to it. Did he think Anne was stalling?

"As a matter of fact," Anne proceeded steadily, "Colonel Russell is a planetary ecologist specializing in the satellites; he's been doing important work for us. He's quite well known in space, and has many friends on the Bridge team and elsewhere. That's correct, isn't it, Colonel Russell?"

"I know most of the Bridge men," Paige agreed, but he barely managed to make his agreement audible. What the girl was saying was adding up to something very like a big, black lie. And lying to MacHinery was a short cut to ruin; only MacHinery had the privilege of lying, never his witnesses.

"The samples Colonel Russell brought us yesterday contained crucial material," Anne said. "That's why I asked him to come back; we needed his advice. And if his samples turn out to be as important as they seem, they'll save the taxpayer quite a lot of money—they may help us close out the project a long time in advance of the projected closing date. If that's to be possible, Colonel Russell will have to guide the last steps of the work personally; he's the only one who knows the microflora of the Jovian satellites well enough to interpret the results."

MacHinery looked dubiously over Paige's shoulder. It was hard to tell whether or not he had heard a word. Nevertheless, it was evident that Anne had chosen her final approach with great care, for if MacHinery had any weakness at all, it was the enormous cost of his continual, overlapping investigations; lately he had begun to be nearly as sure death on "waste in government" as he was traditionally on "subversives." He said at last, "There's obviously something irregular here. We'll check the records and call anyone we need. Horsefield, let's go."

The general trailed him out, his back very stiff, after a glare at Paige which failed to be in the least convincing. The moment the outer door closed behind the two, the reception room seemed to explode. Gunn swung on Anne with a motion astonishingly tigerlike for so mild-faced a man. Anne was already rising from behind her desk, her face twisted with fear and fury. Both of them were shouting at once.

"Now see what you've done with your nosiness—"

"What in the world did you want to tell MacHinery a tale like that for—"

" . . . Even a spaceman should know better than to hang around a defense area—"

" . . . You know as well as I do that those Ganymede samples are trash—"

" . . . You've probably cost us our whole appropriation with your snooping—"

" . . . We've never hired a 'Clean and Routine' man since the project began—"

" . . . I hope you're satisfied—"

" . . . I would have thought you'd have better sense by now—"

"*Quiet!*" Paige shouted over them, with the authentic parade-ground blare. He had never found any use for it in deep space, but it worked now. Both of them looked at him, their mouths still incongruously half opened, their faces white as milk. "You act like a pair of hysterical chickens, both of you! I'm sorry if I got you into trouble—but I didn't ask Anne to lie on my behalf—and I didn't ask you to go along with it, either, Gunn! Maybe you'd best stop yelling accusations and try to think the thing through. I'll try to help, for whatever that's worth—but not if you're going to scream and weep at each other and at me!"

The girl bared her teeth at him in a real snarl, the first time he had ever seen a human being mount such an expression and mean it. She sat down, however, swiping at her patchily red cheeks with a piece of cleansing tissue. Gunn looked at the carpet and just breathed noisily for a moment, putting the palms of his hands together solemnly before his white lips.

"I quite agree," Gunn said after a moment, as calmly as if nothing had happened. "We'll have to get to work and work fast. Anne, please tell me: why was it necessary for you to say that Colonel Russell was essential to the project? I'm not accusing you of anything, but we need to know the facts."

"I went to dinner with Colonel Russell last night," Anne said. "I was somewhat indiscreet about the project. At the end of the evening we had a quarrel which was probably overheard by at least two of MacHinery's amateur informers in the restaurant. I had to lie for my own protection, as well as Colonel Russell's. You know how these things go."

It all came out as emotionlessly as a dictated record. Told in those terms, the incident sounded to Paige like something that had happened to someone whom he had never met, whose name he could not even pronounce with certainty. Only the fact that Anne's eyes were reddened with furious tears offered any bridge between the cold narrative and the charged memory.

"Yes; nasty," Gunn said reflectively. "Colonel Russell, *do* you know the Bridge team?"

"I know some of them quite well, Charity Dillon in particular. MacHinery's check will show that I've no

official connection with the Bridge, though."

"Good, good," Gunn said, beginning to brighten. "That widens MacHinery's check to the Bridge team too, and dilutes it from Pfitzner's point of view—gives us more time, though I'm sorry for the Bridge men. The Bridge and the Pfitzner project both suspect . . . yes, that's a big mouthful even for MacHinery; it will take him months. And the Bridge is Senator Wagoner's pet project, so he'll have to go slowly; he can't assassinate Wagoner's reputation as rapidly as he could some other senator's. Hm-m-m. The question now is just how we're going to use the time."

"When you calm down, you calm right down to the bottom," Paige said, grinning wryly.

"I'm a salesman," Gunn said. "Maybe more creative than some, but at heart a salesman. In that business you have to suit the mood to the occasion. Now about those samples—"

"I shouldn't have thrown that in," Anne said. "I'm afraid it was one good touch too many."

"On the contrary, it may be the only out we have. MacHinery is a practical man. Results are what count with him. So suppose we take Colonel Russell's samples out of the regular testing order and run them through right now, issuing special orders to the staff that they are to find something in them—anything that looks at all decent."

"The staff won't fake," Anne said, frowning.

"My dear Anne, who said anything about faking? Nearly every batch of samples contains some organisms of interest, even if it isn't good enough to wind up among our choicest cultures. You see? MacHinery will be contented by results if we can show them to him, even though the results may have been made possible by an unauthorized person. All this, of course, is predicated on whether or not we have any results by the time MacHinery finds out Colonel Russell *is* an unauthorized person."

"There's just one other thing," Anne said. "To make good on what I told MacHinery, we're going to have to turn Colonel Russell into a convincing planetary ecologist—*and* tell him just what the Pfitzner project is."

Gunn's face fell momentarily. "Anne," he said, "I want you to observe what a nasty situation this strong-arm man has gotten us into. In order to protect our legitimate interests from our own government, we're about to commit a real, serious breach of security—which would never have happened if MacHinery hadn't thrown his weight around."

"Quite true," Anne said. She looked however, rather poker-faced, Paige thought. Possibly she was enjoying Gunn's discomfiture; he was not exactly the first man one would suspect of disloyalty or of being a security risk.

"Colonel Russell, there is no faint chance, I suppose, that you *are* a planetary ecologist? Most spacemen with ranks as high as yours are scientists of some kind."

"No, sorry," Paige said. "Ballistics is my field."

"Well, you have to know something about the planets, at least. Anne, I suggest that you take charge now, I'll have to do some fast covering. Your father would probably be the best man to brief Colonel Russell. And colonel, would you bear in mind that from now on, every piece of information that you're given in our plant might have the giver shot, if MacHinery were to find out about it?"

"I'll keep my mouth shut," Paige

said. "I'm enough at fault in this mess to be willing to do all I can to help—and my curiosity has been killing me anyhow. But there's something you'd better know, too, Mr. Gunn."

"And that is—?"

"That my leave expires in ten days. If you think you can make a planetary ecologist out of me in that length of time, I'll do my part."

"Ulp," Gunn said. "Anne, get to work." He bolted through the swinging doors.

The two looked at each other for a starchy moment, and then Anne smiled. Paige felt like another man at once.

"I'm really sorry," he said. "I came over to apologize for my part in last night's quarrel. Now it seems that I've a bigger hassel to account for."

"Your curiosity is really your major talent, do you know?" she said, smiling again. "It took you only two days to find out just what you wanted to know—even though it's about the most closely guarded secret in the world."

"But I don't know it yet. Can you tell me here—or is the place wired?"

The girl laughed. "Do you think Tru would have talked the way he did if the place were wired? No, it's clean; we inspect it daily. I'll tell you the central fact, and then my father can give you the details. The truth is that the Pfitzner project isn't out to conquer the degenerative diseases alone. It's aimed at the end-product of those diseases as well. *We're looking for the answer to death itself.*"

Paige sat down slowly in the nearest chair. "I don't believe it can be done," he whispered at last.

"That's what we all used to think, Paige. That's what that says." She pointed to the motto in German above the swinging doors. " 'Against Death doth no simple grow.' A law of nature, the old German herbalists thought. But now it's only a challenge. Somewhere in nature there *are* herbs and simples against death — and we're going to find them."

Anne's father seemed both preoccupied and a little worried to be talking to Paige at all, but it nevertheless took him only one day to explain the basic reasoning behind the project vividly enough so that Paige could understand it. In another day of simple helping around the Pfitzner lab running his soil samples—help which consisted mostly of bottle washing and making dilutions—Paige learned the reasoning well enough to put forward a version of it himself. He practiced it on Anne over dinner.

"It all rests on our way of thinking about why antibiotics work," he said, while the girl listened with an attentiveness just this side of mockery. "What good are they to the organisms that produce them? We assumed that the organism secretes the antibiotic to kill or inhibit competing organisms, even though we were never able to show that enough antibiotic for the purpose is actually produced in the organism's natural state in the soil. In other words, we figured, the wider the range of the antibiotic, the less competition the producer had."

"Watch out for teleology," Anne warned. "That's not *why* the organism secretes it. It's just the result. Function, not purpose."

"Fair enough; but right there is the borderline in our thinking about antibiosis. What is an antibiotic to the organism it *kills?* Obviously, it's a toxin. But some bacteria always are naturally resistant to a given antibiotic, and through close-variation and selection they may take over a whole colony. Equally obviously, they would seem to have the antitoxin—an example would be bacteria that

secrete penicillinase, which destroys penicillin.

"Now we add to that still another fact: that both penicillin and oxytetracycline are not only antibiotics *but antitoxins as well.* Both of them neutralize the placental toxin that causes the eclampsia of pregnancy. One of them is a broad-range antibiotic; is there such a thing as a broad-range antitoxin, too? Is the resistance to that particular antibiotic that many different kinds of bacteria can develop all derived from a single counteracting substance? The answer, we know now, is yes. We also have found another kind of broad-range antitoxin — one which protects the organism against many different kinds of antibiotics. I'm told that it's a whole field of research and that we've just begun to scratch the surface.

"Ergo: find the broad-range antitoxin that acts against the toxins of the human body which begin to accumulate after growth stops, and you've got your magic bullet against degenerative disease. Pfitzner already has that antitoxin: its name is ascomycin. How'd I do?" he added anxiously, getting his breath back.

"Beautifully. It's perhaps a little too condensed for MacHinery to follow. Be more roundabout when you talk to him," the girl said. She had taken out of her handbag what appeared to be a small compact, into which she was peering intently. "But you covered only the degenerative diseases. Tell me about the direct attack on death."

Paige looked at the girl for a moment, but her expression was too studied to convey much. He said slowly, "I'll go into that if you like. But your father told me that that element of the work was secret even from the government. Should I talk about it in a restaurant?"

Anne turned the small, compactlike object around, so that he could see that it was in fact a meter of some sort.

Its needle was in uncertain motion, but near the zero-point. "There's no mike close enough to pick you up," she said, snapping the device shut and restoring it to her purse. "Go ahead."

"All right. This end of the research begins back in 1952, with an anatomist named Lansing. He was the first man to show that complex animals—it was rotifers he used — produce a definite aging toxin as a normal part of their growth, and that it gets passed on to the offspring. He bred something like fifty generations of rotifers from adolescent mothers, and got an increase in the life span in every new generation. He ran 'em up from a natural average span of twenty-four days to one of one hundred four days. Then he reversed the process, by breeding consistently from old mothers, and cut the life span of the final generation way *below* the natural average."

"And now," Anne said, "you know more about the babies in our labs than I told you before — or you should. The foundling home that supplies them specializes in the illegitimates of juvenile delinquents—the younger, for our purposes, the better."

"Sorry, but you can't needle me with that any longer. I know now that it's a blind alley. Breeding for longevity in humans isn't practicable. What we want is something much more direct: an antitoxin against the aging toxin of humans. We know that the aging toxin exists in all animals; we know it's a single, specific substance, quite distinct from the ones that cause the degenerative diseases, and that it can be neutralized. When your lab animals were given ascomycin, they didn't develop a single degenerative disease—but they died anyhow at about the usual time, as if they'd been set, like clock, at birth. Which, in effect, they had, by the amount of aging toxin passed on to them by their mothers.

"So what you're looking for now is not an antibiotic—an anti-life drug —but an anti-agathic, an anti-death drug. You're running on borrowed time, because ascomycin already satisfies the conditions of your development contract with the government; as soon as you allow ascomycin to go into production, your government money will be cut down to a trickle. But if you can hold back on ascomycin long enough to keep the money coming in, you'll have your anti-agathic, too."

"Bravo," Anne said. "You sound just like father. I wanted you to raise that last point in particular, Paige, because it's the most important single thing you should remember. If there's the slightest suspicion that we're systematically dragging our feet on released ascomycin—that we're taking money from the government to do something the government has no idea can be done—there'll be hell to pay. We're so close to running down our anti-agathic now that it would be heartbreaking to have to stop, not only heartbreaking for us, but for humanity at large."

"The end justifies the means," Paige murmured.

"It does in this case. I know secrecy's a fetish in our society these days—but here secrecy will serve everyone in the long run, and it's *got* to be maintained."

"I'll maintain it," Paige said. He had been referring, not to secrecy, but to cheating on government money; but he saw no point in bringing that up. As for secrecy, he had no practical faith in it—especially now that he had seen how it worked.

For in the two days that he had been working inside Pfitzner, he had al-

ready found an inarguable spy at the very heart of the project.

IV.

Paige's gift for putting two and two together and getting twenty-two was in part responsible for the discovery, but the almost incredible clumsiness of the spy made the chief contribution to it. Paige could hardly believe that nobody had spotted the man before. True, he was only one of some two dozen technicians in the processing lab where Paige worked; but his almost open habit of slipping notes inside his lab apron, and his painful furtiveness every time he left the Pfitzner building for the night, should have aroused someone's suspicions long before this.

It was a fine example, Paige thought, of the way the blunderbus investigation methods currently popular allowed the really dangerous man a thousand opportunities to slip away. As was usual among groups of scientists, too, there was an unspoken covenant among Pfitzner's technicians against informing on each other. It protected the guilty as well as the innocent, but it would never have arisen at all under any fair system of juridical defense.

Paige had not the smallest idea what to do with his fish once he had hooked it. He took an evening—which he greatly begrudged—away from seeing Anne, in order to trace the man's movements after a day which had produced two exciting advances in the research, on the hunch that the spy would want to ferry the information out at once.

This hunch proved out beautifully, at least at first. Nor was the man difficult to follow; his habit of glancing continually over first one shoulder and then the other, evidently to make sure that he was not being followed, made him easy to spot over long distances, even in a crowd. He left the city by train to Hoboken, where he rented a bicycle and pedaled directly to the crossroads town of Secaucus. It was a long pull, but not at all difficult otherwise.

Outside Secaucus, however, Paige nearly lost his man for the first and last time. The crossroads turned out also to be the site of the temporary trailer city of the Believers, nearly three hundred thousand of them, or almost half of the seven hundred thousand who had been pouring into town for two weeks now for the Meeting. Among the trailers Paige saw license plates from as far away as Eritrea.

Paige's man, after a little thoroughly elementary doubling on his tracks and setting up false trails, ducked into a trailer with a Latvian license plate. After half an hour—at exactly 0200—the trailer ran up a stubby radio antenna as thick through as Paige's wrist.

And the rest, Paige thought grimly, climbing back onto his bicycle, is up to the FBI—if I tell them.

But what would he say? He had every good reason of his own to stay as far out of sight of the FBI as possible. Furthermore, if he informed on the man now, it would mean immediate curtains on the search for the antiagathic, and a gross betrayal of the trust, enforced though it had been, that Anne and Gunn had placed in him. On the other hand, to remain silent, would give the Soviets the drug at the same time Pfitzner found it—in other words, before the West had it as a government. And it would mean, too, that he himself would have to forego an important chance to prove that he was loyal, when the inevitable showdown with MacHinery came around.

By the next day, however, he had hit upon what should have been the obvious course in the beginning. He took a second evening to rifle his fish's laboratory bench—the incredible idiot had stuffed it to bulging with incriminating negatives and bits of paper—and a third to take step-by-step photographs of the hegira to the Believer trailer city and the radio-equipped trailer with the buffer-state license. Assembling everything into a neat dossier, he cornered Gunn in his office and dropped the whole mess squarely in the vice president's lap.

"My goodness," Gunn said, blinking. "Curiosity is a disease with you, isn't it, Colonel Russell? And I really doubt that even Pfitzner will ever find the antidote."

"Curiosity has very little to do with it. As you'll see in the folder, the man's an amateur—evidently a volunteer from the Party rather than a paid expert. He practically led me by the nose."

"Yes, I see he's clumsy," Gunn agreed. "And he's been reported to us before, Colonel Russell. As a matter of fact, on several occasions we've had to protect him from his own clumsiness."

"Why?" Paige demanded. "Why haven't you cracked down on him?"

"Because we can't afford to," Gunn said. "A spy scandal in the plant now would kill the work in its tracks. Oh, we'll report him sooner or later, and the work you've done here will be very useful then. But there's no hurry."

"No hurry?"

"No," Gunn said. "The material he's ferrying out now is of no particular consequence. When we actually have the drug—"

"But he'll already know the production method by that time. Identifying the drug is a routine job for any team of chemists."

"I suppose that's so," Gunn said. "Well, I'll think it over, colonel."

And that was every bit that Paige could extract from Gunn. It was small recompense for his lost sleep, his lost dates, the care he had taken to inform Pfitzner first, or the soul-searching it had cost him to put the interests of the project ahead of his officer's oath and his own safety. That evening he said as much to Anne Abbott, and with considerable force.

"Calm down," Anne said. "If you're going to mix into the politics of this work, Paige, you're going to get burnt right up to the armpits. When we do find what we're looking for, it's going to create the biggest political explosion in history. I'd advise you to stand well back."

"I've been burned already," Paige said hotly. "And tolerating a spy isn't just politics. It's treason, not only by rumor, but in fact. Are you deliberately putting everyone's head in the noose?"

"Quite deliberately. Paige, this project is for everyone—every man, woman and child on the Earth and in space. The fact that the West is putting up the money is incidental. What we're doing here is in every respect just as anti-West as it is anti-Soviet. We're out to lick death for human beings, not just for some one nation's armed forces. What do we care who gets it first? We want everyone to have it."

"Does Gunn agree with that?"

"It's company policy. It may even have been Tru Gunn's own idea."

The notion was startling, to say the least. It gave Paige a picture of Gunn decidedly at variance with the mask of salesman-turned executive which the man himself wore. But it was at least possible.

"You two," he said grimly, "don't

hesitate to trample on the bystanders, do you? Every day I stick with you I get in deeper. First I pose for the FBI as something that I'm not. Then I get possession of information it's unlawful for me to have. And now I'm helping you to conceal the evidence of a high crime. If I didn't know before that you were a pack of idealists, I'd know it now—you've got the appropriate ruthlessness."

"That," Anne said levelly, "is what it takes."

But Paige thought afterwards—is it? Does faith add up to its own flat violation? It was all well enough to have something in which you could believe. But when a faith in humanity in general automatically resulted in casual inhumanity in the particular instance, something must have gone awry. Should the temple bell be struck so continually that it has to shatter?

Or was the fault not in faith itself, but in the faithful? They were usually pretty frightening. Believers and humanitarians alike.

Paige's time to debate the point had already almost run out—and with it, his time to protect himself, if he could. Nothing had emerged from his soil samples. Evidently bacterial life on Ganymede had never at any time been profuse, and consisted now only of a few hardy spores of common species, like *Bacillus subtilis*, which occurred on every Earth-like world. The samples plated out sparsely and yielded nothing which had not been known for decades—as, indeed, the statistics of this kind of research had predicted from the beginning.

It was now known around the Brooklyn plant that some sort of investigation of the Pfitzner project was rolling, and was already moving too fast to be derailed by any method the company's executives could work out. Daily reports from Pfitzner's Washington office were filed in the plant, but they were apparently not very informative; Paige gathered that there was some mystery about the investigation at the source, though neither Gunn nor Anne would say so in so many words.

And finally, Paige's leave was to be over, day after tomorrow. After that, the Persephone station—and probably an order to follow, emerging out of the investigation, which would maroon him there for the rest of his life in the service.

And it wasn't worth it.

That realization had been staring him in the eyes all along. For Anne and Gunn, perhaps, the price was worth paying, the tricks were worth playing, the lying and the cheating and risking of the lives of others were necessary and just to the end in view, but when the last card was down, Paige knew that he himself lacked the dedication. Like every other road toward dedication that he had assayed, this one had turned out to have been paved with pure lead—and had left him with no better emblem of conduct than the miserable one which had kept him going all the same: self-preservation.

He knew then, with cold disgust toward himself, that he was going to use what he knew to clear himself, as soon as the investigation hit the plant; Senator Wagoner, the grapevine said, would be conducting it, and would arrive tomorrow. If Paige timed himself very carefully, he could lay down the facts, leave the plant forever and be out in space without having to face Tru Gunn or Anne Abbott at all. What would happen to the Pfitzner project thereafter would be old news by the time he landed at the Persephone station — more than three months old.

And by that time, he told himself, he would no longer care.

V.

He marched in to meet Senator Wagoner like a man going before a firing squad. A moment later, he felt as though he had been shot down while still crossing the doorsill. Even before he realized that Anne was already in the room, Wagoner said: "Colonel Russell, sit down. I have clearance for you."

"Clearance?" Paige said feebly. Then he saw Anne, and sat down fast. "But if MacHinery—"

"MacHinery is busy. He's collecting a gumshoe detail to investigate the Bridge. I put him up to it myself; the Joint Congressional Committee on Space Flight has decided to wind that project up, so I saw a chance to give Pfitzner the time it needed. In the meantime, Colonel Russell, I had a job for you, so I had you reassigned as a special adviser to Joint. Naturally you had to be cleared for such a job; hence, you're cleared."

"If you don't stop shooting at me," Paige said, "you're going to find me falling over dead all over your desk. Did you know that I came in here with a big load of dirty linen to wash with you? Is that why you laundered me in advance?" He shot a glance at Anne. "Has anybody in this shop told you that it's been coddling a Soviet spy?"

"Yes, Mr. Gunn has given me all that material," Wagoner said. "I'm afraid that he wasn't quite candid with you, colonel, or with Miss Abbott, either. But it had to be played that way. You see, Joint knows about the anti-agathic drug, even though Appropriations and the Pentagon don't. We were in a stew about what to do with it, too. We finally decided to let it leak into the USSR as a matter of policy."

"On humanitarian grounds?" Paige said suspiciously.

"No indeed," Wagoner said, smiling. "Quite the opposite. We have no illusions as to what will happen when a death-curing drug hits a totalitarian society—a drug available in limited quantities only. It won't prove fatal, unhappily, but it is going to make the struggle for succession over there considerably bloodier than it is already. This is one of those little facts of life that we couldn't tell idealists like Miss Abbott; if one values good workers, one doesn't go out of one's way to turn their stomachs."

"That one," Paige said, looking over to her, "has an iron gut if ever I encountered one."

"She didn't give me that impression when I explained the matter to her," Wagoner said. "But to go on. The anti-agathic is going to be just as dangerous to the West as it will be in the USSR. Think for a moment what it will do to religious people alone. What happens to the after-life if you never need to leave this one? And this story is going to break before the Meeting year is over."

"I never thought of that," Anne said suddenly. "And the Believers trust in the literal truth of everything in the Bible—that's why they revise the book every year. 'Unless a seed falleth into the Earth and die—' "

"That's only the beginning," Wagoner said. "Think of what the insurance companies are going to say. And what's going to happen to the whole structure of compound interest. And the whole corpus of the inheritance laws. It's going to be the biggest, blackest social explosion the West has ever had to take.

"And the West can't take it. The dominoes have been falling for some time now. When the anti-agathic is released, the whole structure is going to come down with a roar—probably before the turn of the century."

Paige mopped his forehead. "Don't let MacHinery hear you say that."

"I hope to have MacHinery on Jupiter V when it happens. He'll probably die of apoplexy on the spot, and I for one won't miss him. I expect to have you and Miss Abbott there, too."

"Me?" Paige said. "Not me. I'll be on Persephone."

"Not likely. Colonel Russell, you might as well know the facts now. We're evacuating the West. Not physically, of course, but in essence—in idea. You know, I suppose, that the Bridge gang has enabled us to develop a practical interstellar drive."

"Ye gods, no, I didn't know it. I knew they were working toward something of—"

"They've got it," Wagoner said. "Think about it a minute. Add it to what you know about the Pfitzner project."

Anne, Paige saw, was frowning; evidently this was as new to her as it was to him. He stared back at Wagoner, his head whirling. At last he said:

"So it was long life for spacemen you were after, all the time. Long life for *me*, and for the likes of me."

The senator nodded. "The Soviets can have the Earth," he said. "As a matter of fact they will take it before very long, whether we give it to them or not. But we are going to scatter the West throughout the stars, scatter it with immortal people carrying immortal ideas. People like you, and Miss Abbott."

Paige looked back to Anne. She was aloofly regarding the bewhiskered picture of a Pfitzner Founder, which hung directly above Wagoner's head—the senator had commandeered Gunn's

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office. There was something in her face, however, that Paige could read. He smothered a grin and said: "Why me?"

"Because you're just what we need for the job. I don't mind telling you that your blundering into the Pfitzner project in the first place was an act of Providence from Joint's point of view. When Miss Abbott first showed me your qualifications I thought at first that they'd been faked. You'll come with me and the gumshoe team to Jupiter V, where you'll meet the man who'll direct this colonization project, a Bridge engineer named Robert Helmuth—"

"Senator, I know Helmuth. I met him on my last trip out."

"All the better. He doesn't know a thing about the project at the moment, but he has some mighty shrewd suspicions. You're assigned to give him whatever help he needs, and act as liaison man between the Pfitzner side of the project and the Bridge side. You'll take with you the total output to date of both ascomycin and the new anti-agathic. You'll be instructed in how to take the stuff and how to administer it to others. After that—just as soon as you and Helmuth can work out the details—the stars are yours."

"Anne," Paige said. She turned her head slowly toward him. "Are you with this thing?"

"Ask me later," she said.

That seemed to be good enough. Paige thought about it a moment more. Then something both new and very old occurred to him.

"Senator," he said, "you've gone to an immense amount of trouble to make this whole thing possible—but I don't think you plan to go with us."

"No, Colonel Russell. The stars are for young people—eternally young people. An eternal oldster would be an anachronism."

"Why did you do it, then?"

Anne was on her feet, her eyes suddenly wet, her lower lip just barely trembling. Evidently, over whatever time she had known Wagoner and had known what he had planned, it had never occurred to her that the young-old senator might stay behind.

"Why?" Wagoner said. "You know the answer to that, Colonel Russell. You've known it all your life. I could see it in your face as soon as I told you that we were going out to the stars. Suppose you tell me what it is."

Anne swung her blurred eyes on Paige. He thought he knew what she expected to hear him say; they had talked about it often enough, and it was what he thought he once would have said himself. A special thing, entirely his own, bearing the name of no established dogma, but nevertheless and unmistakably the force to which he had borne allegiance all his life. He could see it in Wagoner's face now, and he knew he had seen it before in Anne's.

"It's the thing that lures monkeys into cages," he said slowly. "And makes cats climb into open desk drawers. With us, it's conquered death and put the stars into our hands. It's a force called curiosity."

"Is that really what you want to call it?" Wagoner said. "Somehow it seems insufficient. Perhaps you'll amend it later, somewhere out by Aldebaran."

He stood up and looked at the two for a moment in silence. Then he said gently:

"*Nunc dimittis.* . . . Now let thy servant depart in peace."

THE END

WEAK SPOT

***Once** someone said that a dog needed fleas to keep his mind off the fact that he was a dog. Maybe, until men are perfect, they need fleas, too . . .*

By ERIC FRANK RUSSELL

Illustrated by Kelly Freas

A GREAT fleet of black ships sprang out of the starfield and took Demeter in thirty hours. There was little destruction and hardly any slaughter. The onset had been too sudden and well-timed, the element of surprise too great to enable the garrison to put up maximum resistance. Demeter fell in a day and a night. It was a triumph for the Barbs and a defeat for the Empire.

The Barbs ran all over the stricken planet and gloated. What they'd got consisted of one medium-sized but livable world on which were three towns, eleven villages, fifty-two mines, fourteen manufacturing plants, a sizable hydroelectric power station, one modern spaceport and seventy thousand prisoners. All in good condition and fit for further service.

Moreover they now had a space station and a potentially redoubtable military outpost thirty degrees around the rim of the Empire with respect to their own eight-planet system. Considering that the said Empire incorporated fifteen hundred solar systems with more than six thousand planets, the Barbs weren't doing so badly for little fellers.

The victors pulsed the news back home where it caused bellicose rejoicing. Millions marched the streets forty abreast in military rhythm, carrying banners, blowing long silver horns and chanting war songs. Kalandar, their supreme overlord, posed on a balcony, waved and smiled while an immense mob in the square below howled its joy and shook defiant fists at the sky. Conscious of the hugeness of the defeated foe the crowd delighted in the thought that the bigger they come the harder they fall.

Kalandar did not miss that point either. True, Demeter was only one inhabitable world and the Empire had a great number more. But what can be done once can be done again—and again and again. So he grinned toothily and drew roars of applause with a bow and a salute.

The situation was one of the most commonplace in history: battle, conquest and the drunkenness of victory. It differed from all others in a single detail of which Kalandar and his warrior hordes remained blissfully unaware, namely, that deep in the heart of the Empire a small group of leaders rejoiced with them.

Demeter has fallen, hurrah, hurrah!

In the big Green Room of the

Palace of Administration seventeen men sat around a horseshoe table and, in effect, composed the living mind of Empire. Beyond the windows soared numberless towers and spires of Gilstrand, capital city of six thousand worlds.

Eldon, a white-haired, big-boned man with immense width of shoulder, accepted a slip of paper from a soft-footed messenger, glanced at it, said evenly to the others, "The Barbs captured Demeter this morning."

"Ho-hum!" said one.

"Nice work!" commented another in the manner of appreciating a favor.

"We must make the most of it, of course," continued Eldon. He turned attention to a sharp-nosed, gimlet-eyed individual sitting on his right. "Get busy, Wanstell. Paste it on the walls."

Wanstell nodded and went out.

The remaining sixteen resumed their original discussion much as if a war and the loss of a world were just one of those things. They talked for an hour coolly, calmly, unhurriedly, with the air of men whose kind lost all capacity for melodramatics twenty, fifty or a hundred generations ago.

In this respect they differed radically from the lizard-skinned, but otherwise humanlike, Barbs who could and did froth and foam all over the place on slightest pretext. The Barbs were by nature hot-blooded fighters, turbulent, truculent, restless, impetuous and supposedly unbeatable by anything less than complete extermination. The seventeen leaders of Empire were by nature cold-blooded calculators, men who esteemed as mightier than the sword the ability to reckon two plus two.

So the ones at the horseshoe table sat undisturbed and chatted until they reached their several decisions and went their various ways. After the last had gone Eldon stood at a window and watched orange rays from the setting sun slowly piercing the purple sky.

Eventually he moved to his desk, sat down, studied a plaque fastened to the wall above. It bore words raised in gilt. He smiled only with the corners of his eyes as he read them.

"An insect may bite a lion—but the insect remains an insect and the lion remains a lion."

Wanstell, as head of the Department of Imperial Communications, officially gave the news to most of a galaxy.

"The government admits the loss of outer solar system T.K.490 containing four planets one of which, Demeter, is inhabitable and settled. Seventy thousand Empire citizens were on Demeter when it was seized by a task force of the Barbs today. The government is about to commence negotiations for the exchange of prisoners and in short time action will be taken to recapture Demeter. All citizens of Empire can rest assured that the situation is well in hand and there is no undue cause for alarm."

Smooth political words such as had been used back to the dawn of time when the birthplace of Empire was a watery world called Terra. And, exactly as it had been in those far-off days, the independent news-services heated the handout and distributed it on the boil.

SWIFT BARB VICTORY screamed the radiocasts around Sirius. DEMETER LOST WHILE NAVY SLUMBERS snarled the always irritable and antigovernmental videos of the Wolf system. THE HOUR IS AT HAND editorialized the primitive but influential news sheets of the distant Rimbold group.

"For at least twenty thousand

years," lectured the dignified Gilstrand *Sentinel*, "and for nobody knows how much longer the Barbarians have been an unmitigated nuisance. While they continue to exist as a unified fighting force the fringes of Empire remain unsafe. So long as once in every century they make a reckless penetration of our sphere of space there is no security anywhere. It is high time we brought accord among our conflicting interests, ceased our petty squabbling, stood firmly shoulder to shoulder and put an end to this menace once and for all."

And so on and so on. Each solar group fulminated according to the peculiar psychology of that group. Time had run on so long that while all citizens of Empire were men they were different groups with different cultures, different motivations, different modes of thought. The Empire had

incubated fifteen hundred new races with fifteen hundred angles on any one problem.

The repercussions following the fall of one relatively unimportant planet jolted far across the cosmos and proved that action and reaction may be opposite but grossly unequal. The effect somewhat resembled the ripples that once spread across an oldtime world after a minor massacre by Sioux.

These things were to be expected. Indeed, experts in such matters could plan them in advance and calculate with a reasonable degree of precision the amplitude and impact of the emotional splash on some sparsely settled planet a thousand light-years away.

The Barbs worked with furious energy typical of their kind. Their ships fled back and forth pouring troops and supplies into Demeter in haste to consolidate the position before the Empire could organize its counterblow.

None doubted that ultimately such a wallop would come or that when it did it would be good and hard. They knew the Empire fully as well as it knew them. The two foes had lived in juxtaposition a long time, a very long time. They enjoyed the mutual understanding of those who co-exist for millennia in a state of platonic hatred.

While the Barbs moved heaven and earth to turn Demeter into an inviolable fortress of space, certain of their vessels made fast runs to the neutral world of Kvav where prisoners were solemnly exchanged. This was a post-victory formality unthought-of before the expanding frontiers of Empire had reached them. In olden times prisoners were enslaved, worked until they dropped and then slaughtered. The Empire had introduced the swap-system and after a period of dark suspicion the Barbs had accommodated themselves to it. Since in their own opinion one Barb was worth ten Imperials an even trade had them head of the queue at the bargain counter.

Prisoner-exchange had changed the shape of never-ending war so far as the Barbs were concerned. Space battles and territorial conquests were no longer enough. Now there must be raids to obtain prisoners whenever the numbers held by both sides failed to balance. For some unaccountable reason the onus of redressing the balance fell on the Barbs more often than on the Empire. Today it was a major victory to snatch a thousand Empire citizens and thus ensure the return of one thousand of their own.

A minor Barb squadron ferried between Demeter and Kvav, dumped seventy thousand of the enemy, took home the same number of Barbs some of whom had waited four or five years for rescue. The whole procedure went like clockwork.

Nobody bollixed the arithmetic by seizing a Barb ship coming or going.

The Empire had vast fleets patrolling elsewhere.

And nobody thought it strange.

Eldon and Wanstell sat at the former's desk checking intelligence reports. Reactions of Empire newschannels were in their estimation most satisfactory. The doings of the Barbs were also pleasing. Both men were humorously conscious of their inability to solve the problem of how to give Kalandar a medal without creating ructions around fifteen hundred suns.

They and the absent ones had a task that an ordinary engineer would consider beyond credulity: they were skilled operators of a gigantic machine that functioned better for a spanner thrown in the works.

Proof lay before them. On Quimper

a threatening revolt of the young against the old had gone pop like a burst bubble as overenergetic ringleaders rushed into the space-navy. Twenty-four worlds planning an independent customs union had dropped the notion in favor of a common space-push.

Two hundred eighty highly individualistic frontier planets, yesterday increasingly defiant of central authority, today had taken alarm and were yelling for protection. The pacifist Rigellians were offering a contribution to defense formerly refused. The twin systems near Bootes had abandoned fatheaded ideas of civil war and decided to rival each other in smacking the Barbs. Public opinion around Arcturus had upped and voiced itself against a strong movement for secession.

A thousand items in more or less similar strain proved that in given circumstances a thrown spanner boosts efficiency by quite a percentage.

Only one thing threatened to spoil the whole business and of that they knew nothing just then. Outside, slowly mounting the stairs, was a trio bearing a metaphorical spanner far too big.

One of these three who was a Palace of Administration official knocked and entered, leaving the others beyond the door. He said to Eldon, "Sir, we have struck a slight complication over exchange of prisoners."

"In what way?" Eldon asked.

"Kalandar demands the return of Jazan, his youngest son, a former pilot. We captured him two and a half years ago, if you recall."

"I do not recall," said Eldon, frowning. "He is of no importance to us anyway. It is a strict rule that prisoners be returned in order of capture regardless of rank or station. I know of no reason why Jazan should not be handed over." He cocked an eye at the other. "Is there any reason?"

"Yes, sir."

"What is it?"

"Jazan does not wish to return—just yet."

"Does not wish to?" Eldon echoed it incredulously. A Barb uneager to resume the fray was unique. "Why not?"

"That, sir, might be better explained by the chaplain if you would care to see him."

"Show him in," ordered Eldon.

The other went to the door, brought back a plump, solemn-faced cleric. The newcomer sat in response to Eldon's gesture, folded hands in his lap.

"Well, what do you wish to tell me?"

"As you may know, I am the chaplain of Number Twelve camp," the newcomer explained. "It is a difficult post. It means one must try to create a little flock out of a bunch of wolves. However, I have made an important convert."

"Jazan?"

"Yes." He brooded a moment, looked vaguely uncomfortable. "You know the nature of the Barbs. They are highly emotional and tend toward fanaticism. The good Lord made them that way for reasons of His own."

"Well?"

"Generally speaking, a converted Barb tries to be ten times more Christian than any Christian. His make-up being what it is there's no holding him back. He wants to go out and save the whole of Creation. He has the inborn character of a missionary—and a martyr."

"What does this mean to us?"

"Everything is created for a good and wise purpose," asserted the chaplain. "Jazan firmly believes that he

and his kind were made to be the Empire's missionaries in the great beyond, in the vastness of space yet to be explored. He wishes to discuss the matter with you and refuses to go home until he has done so."

Eldon glanced toward Wanstell, found that worthy studiously examining the ceiling. He returned his attention to the chaplain.

"All right, I will see him now—alone."

Jazan proved to have the typical thinness, height and lizard skin of his kind. He also had the fiery eyes, though now they were modified by the light of inward mysticism.

He stood before Eldon, head slightly bowed, hands behind his back, and said quietly, "It is for me to lead my father into the path of truth. Also my brothers and my people. I ask you to cease all hostilities coincidental with my return."

"And if we do not?"

"I shall pray for you as for every other sinner."

"We shall stop fighting after your people have learned to be good, not before," declared Eldon, flatly. "And that's going to be a long, long time."

"They will see the light. And, seeing it, they will bear it abroad. Your ships will follow in peace the paths our feet have trod."

"We'll try it when that day comes," said Eldon. "But it isn't here yet."

The fire momentarily blazed in Jazan's eyes. A characteristic blue flush of temper swept across his face but was suppressed. For a Barb he was unusually intelligent and self-disciplined.

He said, "I am going to change my people whether you co-operate or not. The meek shall inherit while the proud shall be laid low. You should be willing to help. My kind could be most useful to you some day." His lowered head came up and he gazed straight into Eldon's eyes as he added, "Even more useful than they are now!"

"What do you mean by that?" demanded Eldon.

"As a true believer I have learned something of the real power of the Empire. It is infinitely greater than my own people believe. It is so great that you could destroy us overnight, could have done so many centuries ago." His gaze met the other again. "Why haven't you destroyed us?"

Eldon pointed to the plaque. "You cannot diminish the lion no matter how much you bite."

"Why permit us to bite at all?"

Resting himself on the corner of the table, Eldon said:

"I'll have to use a simple analogy. You know how a steam boiler functions?"

"Yes, of course."

"In theory a weak spot in a boiler could lead to an explosion. In practice it doesn't. Like me to tell you why?"

"Go on."

"Because the intelligent human mind is anticipatory. When we construct a boiler we build in a weak spot pre-set to give way at a little above maximum working pressure. The accidental bang never comes because it's beaten to the draw by a predesigned fizz. The created weak spot is called a safety valve. It pipes away surplus pressure."

"I can understand that much."

"The Empire," Eldon continued, "can be likened to an enormous boiler working under a multitude of varying pressures created by competition, rivalries, conflicting interests and scores of other inevitabilities. It cannot be made bigger until we find a way of crossing the great chasms beyond our borders."

"I see."

"Meanwhile, your warlike people hang around and obligingly pipe off our surplus steam. It is very kind of you. We appreciate it. So long as you continue to play your part we're not in danger of going bang."

"Have you any objection to me giving my people these facts?"

"None at all," assured Eldon, smiling. "Most of them will not believe you and the few who do will be mightily annoyed. The latter will find themselves in a chronic jam because they cannot vent their annoyance without playing our game."

"And you refuse to call off the war?"

"We cannot end that which we did not start in the first place," said Eldon. "Look, if you care to check history, you'll find the Empire has never struck first. It has always waited to be hit before hitting back, carefully and judiciously so as not to impair your function as a necessary enemy. Aggression is your proper part. We have no desire to deprive you of it."

"That means the initiative lies with us," observed Jazan, shrewdly. "And you cannot dictate our use of it. Therefore I am going home. I am going to face you with the problem of peace."

"If your bellicose folk will let you live that long."

Jazan departed, quietly. Eldon walked twice round the room, had his usual look out the window and then returned to his desk. Fingering the intercom board, he selected a button, pressed it, spoke to the voice that answered.

"Sanders, time is getting too short for my liking. That research into the super-drive must be given top priority as from now." He paused, listened, exclaimed, "Damn the armaments campaign! I said top priority!"

The chasm was the real foe.

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OF COURSE

The Aliens *in their titanic star-cruiser said they would take one man—and pay with whatever his culture needed. But—what was their idea of Earth's highest culture . . . ?*

By CHAD OLIVER

Illustrated by van Dongen

IN Bern, Switzerland, quite early in the morning, the President woke up with a splitting headache. He hadn't been sleeping well for the past three weeks, and last night had been worse than usual. He stayed in bed for a few minutes, frowning at the ceiling. It was an unpleasant situation to be in; there was no denying that. The President, however, had confidence. Surely, with its record since the Congress of Vienna in 1815, the outlook was good for his country. The President managed a smile. Switzerland would be the one, of course.

In Moscow, Russia, seated at the end of a long table, the Premier listened intently to his chief military advisors. He didn't like what he heard, but he kept his face expression-

less. He didn't like the position in which he found himself, but he wasn't really worried. There could be no doubt whatever that the Supreme Soviet would be the one chosen. Of course!

In London, England, the Prime Minister stepped out of 10 Downing Street, his pipe smoking determinedly. He climbed into his car for the drive to the Palace, and folded his strong hands. Things might be a bit touch-and-go for a short time, but the Prime Minister was undismayed. England, with its glorious history, was the only possible choice. Of course, it would be England!

To the east of Lake Victoria in Africa, the tall, slender priest-chief of the Masai, the Laibon, looked out upon the humped cattle grazing on the grassland and smiled. There was but one true God, Em-Gai, and the pastoral Masai were proud. At long last, ancient wrongs would be corrected! The Masai would rise again. They were the only logical choice. Of course . . .

And so it went, around the world.

The somewhat dumpy gentleman in the rimless spectacles and the double-breasted suit had a name: Morton Hillford. He had a title to go with the name: presidential advisor.

Right now, he was pacing the floor.

"You say you've investigated *all* the possibilities, general?" he demanded. "All the . . . um-m-m . . . angles?"

The general, whose name was Larsen, had an erect bearing and iron-gray hair, both of which were very useful when senators had to be impressed. He was a general who knew his business. Naturally, he was upset.

He said: "Every possible line of action has been explored, Mr. Hillford. Every angle has been studied thoroughly."

Morton Hillford stopped pacing. He aimed a forefinger at the general as though it were a .45. His expression indicated strongly that if there had been a trigger he might have pulled it. "Do you mean to tell me, sir, that the United States Army is impotent?"

The general frowned. He coughed briefly. "Well," he said, "let's say that the United States Army is *helpless* in this matter."

"I don't care what words you use! Can you *do* anything?"

"No," said the general, "we can't. And neither, may I point out, can the Navy, the Air Force, or the Marines."

"Or the Coast Guard," mimicked Morton Hillford. He resumed his pacing. "Why *can't* you do anything? That's your job, isn't it?"

General Larsen flushed. "I'm sorry, Mr. Hillford. Our job, as you point out, is to defend this country. We are prepared to do that to the best of our ability, no matter what the odds—"

"Oh, forget it, Larsen. I didn't mean to get under your hide. I guess my breakfast just didn't agree with me this morning. I understand your position in this matter. It's . . . embarrassing, that's all."

"To say the least," agreed General Larsen. "But I venture to say that we've thought of everything from hydrogen bombs to psychological warfare. We have absolutely nothing that stands the ghost of a chance of working. A hostile move on our part would be suicide for all of us, Mr. Hillford. I deplore melodrama, but facts are facts. It wouldn't do to let the people know just how much in their power we are, but nevertheless we *are* on the hook and there isn't any way that I know of to get off again. We'll keep trying, naturally, but the President must have the

correct facts at his disposal. There isn't a thing we can do at the present time."

"Well, general, I appreciate your candor, even if you have little else to offer. It looks as though we will have to keep our fingers crossed and a great big smile on our collective face. The President isn't going to like it though, Larsen."

"I don't like it either," Larsen said.

Morton Hillford paused long enough to look out the window at the streets of Washington. It was summer, and the sun had driven most people indoors, although there were a few helicopters and cars visible. The old familiar buildings and monuments were there, however, and they imparted to him a certain sense of stability, if not of security.

It's not the heat, his mind punned silently, *it's the humility.*

"We'll just have to trust to their good judgment, I suppose," Morton Hillford said aloud. "It could be worse."

"Much worse," the general agreed. "The position of the United States in the world today—"

Hillford brushed the words aside impatiently. "There isn't the slightest doubt of it! That isn't our problem. Of *course* the United States will be chosen."

"Of course," echoed the general.

"And then everything will be all right, won't it, Larsen?"

"Of course!"

"Just the same," said Morton Hillford pointedly, "you find us a weapon that will work, and do it in a hurry."

"We'll try, Mr. Hillford."

"You *do* it, general. That's all for today."

The general left, keeping his thoughts to himself.

Morton Hillford, presidential advisor, resumed his pacing. Fourteen steps to the window, fourteen steps back. Pause. Light a cigarette. Fourteen steps to the window—

"Of course," he said aloud, "it will be the United States."

And his mind added a postscript: *It had BETTER be the United States.*

Three weeks ago, the ship had come out of space.

It was a big ship, at least as far as Earth was concerned. It was a good half-mile long, fat and sleek and polished, like a well-fed silver fish in the shallows of a deep and lonely sea. It didn't do much of anything. It just hung high in the air directly above the United Nations building in New York.

Waiting.

Like a huge trick cigar about to blow up in your face.

Simultaneously with its appearance, every government on Earth got a message. Every government got the same message. The ship wasn't fussy about defining "government" either. It contacted every sort of political division. In certain instances where the recipients were illiterate, or nonliterate, the message was delivered vocally.

Every message was sent in the native language. In itself, that was enough to give a man food for thought. There were a lot of languages on Earth, and many of them had never been written down.

The people who came in the ship, what was seen of them, looked quite human.

There was a great deal of talk and frenzied activity when the spaceship and the messages appeared. For one thing, no one had ever seen a spaceship before. However, the novelty of that soon wore off. People had been more or less expecting a spaceship, and they tended to accept it philosophi-

cally, as they had accepted electricity and airplanes and telephones and atom bombs. Fine stuff, naturally. What's next?

The message was something else again.

The United Nations and the United States greeted the ship from space with about one and a half cheers. Contact with other worlds was very dramatic and important and all that, but it *did* pose a number of unpleasant questions.

It is difficult to negotiate unless you have something to offer, or else are strong enough so that you don't have to dicker.

Suppose the ship wasn't friendly?

The United States dug into its bag of military tricks and investigated. They weren't fools about it, either. No one went off half-cocked and tried to drop a hydrogen bomb on an unknown quantity. It was recognized at once that dropping a bomb on the ship might be like hunting a tiger with a cap pistol.

The military looked into the matter, subtly.

They probed, gently, and checked instruments.

The results were not encouraging.

The ship had some sort of a field around it. For want of a better name, it was called a force field. Definitely, it was an energy screen of some sort —and nothing could get through it. It was absolutely impregnable. It was the ultimate in armor.

If a man has really foolproof armor and you don't, then you're out of luck.

The military couldn't fight.

After digesting the message, there didn't seem to be much for the diplomats to do either.

The message contained no explicit threat; it was simply a statement of intentions. If anything, it suffered from a certain annoying vagueness that made it difficult to figure out exacly *what* the ship was going to do.

The message read:

"PLEASE DO NOT BE ALARMED. WE HAVE COME IN PEACE ON A MISSION OF GOOD WILL. OUR TASK HERE IS TO DETERMINE TO OUR SATISFACTION WHICH ONE AMONG YOU HAS THE MOST ADVANCED CULTURE ON YOUR PLANET. IT WILL BE NECESSARY TO TAKE ONE REPRESENTATIVE FROM YOUR MOST ADVANCED CULTURE BACK WITH US FOR STUDY. HE WILL NOT BE HARMED IN ANY WAY. IN RETURN FOR HIM, WE WILL UNDERTAKE TO SUPPLY HIS CULTURE WITH WHATEVER IT MOST DESIRES, TO THE BEST OF OUR ABILITIES. WE SINCERELY HOPE THAT WE WILL CAUSE YOU NO INCONVENIENCE AS WE WORK. IT IS SUGGESTED THAT YOU DO NOT ATTEMPT TO COMMUNICATE WITH THIS SHIP UNTIL OUR CHOICE HAS BEEN ANNOUNCED. IT IS ALSO SUGGESTED THAT HOSTILE ACTION ON YOUR PART SHOULD BE CAREFULLY AVOIDED. WE HAVE COME IN PEACE AND WISH TO LEAVE THE SAME WAY WHEN OUR JOB IS DONE. THANK YOU FOR YOUR COURTESY. WE ARE ENJOYING YOUR PLANET."

That was all.

On the face of it, the message was not too alarming, however unprecedented it may have been. However, second thoughts came fast.

Suppose, thought the United States, that Russia is chosen. Suppose, further, that what Russia most desired was an unbeatable weapon to use against the United States—what then? And suppose, thought Russia, that the United States is chosen—

The situation was somewhat uncomfortable.

It was made decidedly worse by the complete helplessness of the contestants.

There wasn't a thing they could do except to wait and see.

Of course, every single government involved was quite sure that it would be the one chosen. That being the case, the more discerning among them realized that no matter *who* was selected it would come as a shocking surprise to all the rest.

It did.

Morton Hillford, advisor to the President, got the news from the chief American delegate to the United Nations. The delegate hadn't trusted anyone with *this* hot potato; he had come in person, and at full speed.

When he got the news, Morton Hillford sat down, hard.

"That's ridiculous," he said.

"I know it," said the delegate. The shock had partially worn off for him, and he kept on his feet.

"I don't believe it," said Morton Hillford. "I'm sorry, Charlie, but I just don't believe it."

"Here," said the delegate, handing him the message, "you read it."

Hillford read it. His first impulse was to laugh. "Why, they're crazy!"

"Hardly."

Hillford managed to get to his feet and resume his pacing. His rimless spectacles were getting fogged from the heat, so he wiped them off with his handkerchief.

"I feel like a fool," he said finally. He shook the message, almost angrily. "It's such a terrific anticlimax, Charlie! Are you sure they're not joking?"

"They're dead serious. They're going to exhibit the man in New York tomorrow. After that, they're going to show him off in every other capital on Earth. After *that*—"

He shrugged.

Morton Hillford felt a sick sinking in the pit of his stomach. "Do you want to tell the Boss, Charlie?"

"No," said the delegate. "A thousand times no. I've got to get back to the U.N., Mort. *You* tell him."

"Me?"

"Who else?"

Morton Hillford accepted his burden with what stoicism he could muster. His not to reason why—

"Let's have a drink first, Charlie," he said wearily. "Just a small one."

As it turned out, they both told him.

The President eyed them intently, hands on his hips, and demanded to see the message. They showed it to him.

The President was not a handsome man, but he had strength in his features. His rather cold blue eyes were alert and intelligent, and they seldom followed his mouth's lead when he smiled.

He wasn't smiling now, anywhere.

"Well, Boss," asked Morton Hillford, "what do we do now?"

The President frowned. "We'll have to go on with a telecast as soon as possible," he said, speaking with authority. "We'll have to tell the people *something*. Get Doyle and Blatski on that right away, Mort—and tell them to write it up with some sort of a positive slant if they can. Soothe their pride, indicate we're not unwilling to learn, throw in something about unknown science and mysterious factors . . . you know. After that, we'll have to get a project set up to study this whole affair." He consulted the message again. "Hm-m-m. I see they're coming back again in one hundred of our years to check up on us. Fine! By then we may have some-

thing to argue with in case they mean trouble, although I doubt it. I pity the man in office when they come back—I hope he's a member of the Loyal Opposition. Now! We've got to find out what this is all about."

The United Nations delegate ventured one word: "How?"

The President sat down at his desk and lit a cigarette. He blew smoke out through his compressed lips, slowly. It was a good pose, and he liked it. As a matter of fact, he was a man who relished difficult problems—even this one. He liked action, and routine bored him.

"We need a scientist," he announced. "And not a nuclear physicist this time. We need someone in here who can tell us something about these people. The fact is, we need a *social* scientist."

Morton Hillford warned: "Don't let the *Tribune* find out. They'll crucify you."

The President shrugged. "We'll keep it quiet," he said. "Now! As I said, we need a social scientist. The question is, which kind?"

"Not a psychologist," mused Morton Hillford. "Not yet, anyway. I'm afraid we need a sociologist. If the *Tribune* ever finds out—"

"Forget the papers, man! This is important."

The President got to work on his private phone. "Hello . . . Henry? Something has come up. I want you to get over here right away, and I want you to bring a sociologist with you. That's right, a *sociologist*. What's that? Yes, I KNOW about the *Tribune!* Bring him in the back door."

In due course of time, Henry—who was Secretary of State—arrived. He brought a sociologist with him. The sociologist was unexpectedly normal looking, and he listened respectfully to what the President had to say. He was naturally surprised when he heard about the ship's choice, but he recovered himself quickly.

The sociologist was an honest man. "I'm terribly sorry, Mr. President," he said. "I could take a stab at it if you like, but what you really need is an anthropologist."

The President drummed his fingers on his desk. "Henry," he said, "get me an anthropologist over here, and hurry."

Henry hurried.

Four hours later, the anthropologist was shown into the President's office. His name was Edgar Vincent, he had a beard, and he smoked a foreign-looking pipe. Well, that couldn't be helped.

Introductions were hastily made.

"You are an anthropologist?" asked the President.

"That's right, sir," said Dr. Vincent.

"Fine!" said the President. He leaned back in his chair and folded his hands. "Now we're getting somewhere."

Dr. Vincent looked blank.

"Tell me, doctor," said the President, "what do you know about the Eskimos?"

The anthropologist stared.

"You don't mean—"

To save time, the President handed him the message that had been sent by the ship to the United Nations. "You might as well read this, doctor," he said. "It will be released to the papers within an hour anyway, and then everybody will know."

Edgar Vincent puffed on his pipe and read the message:

"WE BRING YOU GREETINGS AND FAREWELL. OUR WORK AMONG YOU HAS NOW BEEN COMPLETED. WE HAVE FOUND

THE MOST ADVANCED CULTURE AMONG YOU TO BE THAT OF THE CENTRAL ESKIMO OF BAFFIN LAND. WE HAVE SELECTED ONE MEMBER OF THAT CULTURE TO GO BACK WITH US FOR STUDY. AS INDICATED EARLIER, WE WILL UNDERTAKE TO PROVIDE HIS CULTURE WITH WHATEVER IT MOST DESIRES, BY WAY OF PAYMENT. THE REPRESENTATIVE OF THE HIGHEST CULTURE ON YOUR PLANET WILL BE EXHIBITED IN ALL YOUR POLITICAL CENTERS, AT TIMES WHICH WILL BE INDICATED IN A SEPARATE COMMUNICATION, TO PROVE TO YOU THAT HE HAS NOT BEEN HARMED. WE WILL RETURN TO YOUR WORLD IN ONE HUNDRED EARTH-YEARS, AT WHICH TIME WE HOPE TO DISCUSS MUTUAL PROBLEMS WITH YOU AT GREATER LENGTH. THANK YOU AGAIN FOR YOUR COURTESY. WE HAVE ENJOYED YOUR PLANET."

"Well?" asked the President.

"I hardly know what to say," said the anthropologist. "It's fantastic."

"We already know that, doctor. Say *something*."

Edgar Vincent found a chair and sat down. He stroked his beard thoughtfully. "In the first place," he said, "I'm not really the man you want."

Henry groaned. "You're an anthropologist, aren't you?"

"Yes, yes, of course. But I'm a *physical* anthropologist. You know—bones and evolution and blood types and all that. I'm afraid that isn't quite what you're after here." He held up his hand, holding off a wave of protest. "What you need is an ethnologist or social anthropologist, and the man you ought to get is Irvington; he's the Central Eskimo man." He held up his hand again. "Just a moment, please gentlemen! As I say, you need Irvington. You won't be able to get him for some time, however. I suggest you put in a call for him—he's in Boston now—and in the meantime I'll fill you in as best I can. I do know a *little* cultural anthropology; we're not as specialized as all that."

Henry left to put in the call, and then hurried back. Vincent permitted himself a faint smile. It had been a long time since he had an audience *this* attentive!

"Can you think of any possible reason why an Eskimo might have been chosen?" asked Morton Hillford.

"Frankly, no."

"A secret civilization?" suggested the United Nations delegate. "A lost tribe? Something like that?"

Vincent snorted. "Nonsense," he said. "Sir," he added.

"Look," said the President. "We know they live in igloos. Go on from there."

Vincent smiled. "Even that isn't quite correct, I'm afraid," he said. "Begging your pardon, sir, but the Eskimos don't *live* in igloos, at least not most of the time. They live in skin tents in the summer, stone and earth houses in early winter—"

"Never mind that," the President said. "That's not important."

Vincent puffed on his pipe. "How do you know it isn't?"

"What? Oh . . . yes. Yes, I see what you mean." The President was nobody's fool. It was hardly his fault that he knew nothing about Eskimos. Who did?

"That's the catch, as you are beginning to understand, sir," Vincent said.

"But look here," put in Morton

Hillford. "I don't mean to belittle your field of learning, doctor, but the Eskimos simply aren't the most advanced civilization on this planet! Why, we've got a technology hundreds of years ahead of theirs, science they can't even guess at, a Bill of Rights, a political system centuries in the making—thousands of things! The Eskimos just don't rate."

Vincent shrugged. "To you they don't," he corrected. "But you're not doing the evaluation."

Morton Hillford persisted. "Suppose you were making the choice, doctor. Would *you* choose an Eskimo?"

"No," admitted the anthropologist. "Probably not. But then, I'm looking at it from roughly the same values that you are. I'm an American too, you know."

"I think I see the problem," the President said slowly. "The people on that ship are far ahead of us—they must be, or they wouldn't *have* that ship. Therefore, their standards aren't the same as our standards. They're not adding up the points the same way we are. Is that right, doctor?"

Vincent nodded. "That's what I would say, at a guess. It stands to reason. Maybe our culture has overlooked something important—something that outweighs all the big buildings and mass production and voting and all the rest of it. How do we know?"

The President drummed his fingers on his desk. "Let's look at it this way," he suggested. "Could it be that spiritual values are more important than technological progress—something like that?"

Vincent considered. "I don't think so," he said finally. "It might be *something* like that, but then why choose the Eskimos? There are plenty of people worse off in a technological sense than they are—the Eskimos are quite skilled mechanically. They've invented a number of things, such as snow goggles and hunting techniques and intricate harpoon heads. They're quite good at gadgetry, as a matter of fact. I don't think we can throw technology out the window; it isn't that simple. And as for 'spiritual values,' they're apt to be tricky to handle. Offhand, I wouldn't say that the Eskimos had any more than other people, and it's even possible that they have less. Look at India, say—they have *really* put the emphasis on religion. I think you're headed in the right direction, maybe, but you're not on the right track yet."

The delegate from the United Nations wiped his brow. "Well then, what *have* the Eskimos got?"

"I can only give you one answer to that," Vincent said. "At any rate, only one *honest* answer: I don't know. You'll have to wait for Irvington, and my guess is that he'll be just as surprised as anyone else. I haven't the faintest idea why the Eskimos should be picked out of all the peoples on Earth. We'll just have to find out, that's all—and that means we'll have to know a lot more about *every* group of people on this planet than we know now, to find out what the Eskimos have got that the others *haven't* got."

"More money," sighed the President, a trifle grimly. "Doctor, can't you give us something to go on, just provisionally? I've got a cabinet meeting in an hour, and I have to go in there and say something. And after that, there'll be a television address, and the newspapers, and the foreign diplomats, and Congress, and God knows what all. This won't be so funny a few years from now. Any ideas, doctor?"

Vincent did his best. "The Eskimos

have made a remarkable adjustment to their environment at their technological level," he said slowly. "They're often used as examples of that. I recall one anthropologist who mentioned that they have no word for war, and no conception of it. That might be a good angle to work on. For the rest, you'll have to talk to Irvington. I'm out of my element."

"Well, thanks very much, Dr. Vincent," the President said. "I appreciate your help. And now, let's *all* have a small drink."

They adjourned to another room, all talking furiously, to get ready for the cabinet meeting to come.

Morton Hillford was the last to leave the President's office.

"Eskimos," he said sadly, shaking his head. "*Eskimos.*"

Next morning, strictly according to schedule, a smaller ship detached itself from the huge spaceship that hovered high in the sky above the United Nations building in New York.

For the onlooking millions, in person and via television, it was difficult to avoid the impression of a cigarette emerging from a large silver cigar.

The little ship landed, as gently as a falling leaf, in the area that had been cleared for it. A small bubble of force, glinting slightly in the morning sun, surrounded the ship. A circular portal slid open and the exhibition began.

It was simplicity itself.

Two tall, pleasant-looking men stepped out of the ship, staying within the energy shield. Their dress was unique, but rather on the conservative side. They leaned back into the portal and appeared to be speaking to someone.

A bit reluctantly, the Eskimo stepped outside and stood with them. He was dressed in new clothes and looked uncomfortable. He was short, a little on the plump side, and his hair was uncombed.

He gaped at New York City in frank astonishment.

He smiled with shy pleasure.

With only a trace of prompting from the two men, he waved cheerfully to the crowd that had gathered to see him. He stood there, smiling, for two minutes, and then he was escorted back into the ship.

The ship floated soundlessly into the air, and curved up to rejoin the larger ship above.

That was all there was.

The exhibition was over.

Right on schedule, it was repeated elsewhere.

In Bern, Switzerland.

In Moscow, Russia.

In London, England.

In the land of the Masai, in East Africa.

In China, Sweden, Australia, Mexico, Finland, Brazil, Samoa, Turkey, Greece, Japan, Tibet—

All around the world.

And, of course, everywhere the ship went it raised some highly annoying questions. Of course, every government *knew* that a mistake had somehow been made.

But just the same—

As suddenly as it had come, the great spaceship was gone. Its jets flickered with atomic flame, its outlines blurred, and it flashed back into the dark sea from which it had come.

It was headed for Procyon, eleven light-years distant, to check up on the results of a previous experiment that had taken place roughly a century ago.

The Eskimo wandered about the ship, munching on a fish, and tried to figure out what was going on.

Two men watched him, amused but not impressed.

"Well, anyhow," observed the first man, "his people will have plenty of seals from now on."

"Right enough," agreed the second man. "And we can put *him* down on Armiqe—he should be right at home there, and no harm done."

"It's high time we got around to Earth, if you ask me," said the first. "That planet is getting to be the eyesore of our sector."

"Oh, Earth will come along," said the second. "They really *are* making some progress down there, finally."

The Eskimo selected another fish out of his private bucket and watched the two men without interest.

"It must have been something of a shock when we selected *him*. An awfully nice chap, but he *is* a bit on the primitive side."

"A slight stimulus never hurt anyone, my friend. By the time they get through worrying about that Eskimo, they ought to have a *real* science down there."

The first man yawned and stretched. "And when we come back in a hundred years," he said, "you know which one of them we'll find with a culture *really* advanced enough so that we can offer them a place in Civilization."

The second man nodded. "Of course," he said, and smiled.

The Eskimo helped himself to another fish out of the bucket and wandered over to the window.

THE ANALYTICAL LABORATORY

July 1954 Issue

Place	*Story*	*Author*	*Points*
1.	Sucker Bait (Pt. I)	Isaac Asimov	1.65
2.	Royal Road	A. A. Smith	2.68
3.	The Greater Thing	Tom Godwin	3.20
4.	Runaway Home	E. G. von Wald	3.45
5.	Amateur	Lee Correy	3.68

The more I try to figure out what these score-sheets mean, the more complex the problem looks. There's something shaping up on next month's An Lab report that looks as though it would be even more puzzling. My job is to try to get stories you'll enjoy—but it's definitely an art, not a science!

Of course, that's what makes it fun; if it were a true science, a machine could do it, and who wants to spend his time doing something a machine could do easier and better?

THE EDITOR

BIAS

It doesn't matter much whether an occupation is good or evil, needed or useless; the troubles a man gets into depend on what his neighbours believe *is necessary.*

By J. T. McINTOSH

Illustrated by van Dongen

I.

JACQUES DELAVONNE was reading his paper as he stepped into the street. The main reason for his contempt of the silent, flashing traffic was that he had been crossing streets for nearly thirty years and was still alive. Another was that here in Nark—still spelt New York—the traffic was slow and sedate in comparison with that of his native Paris.

Automatically he made due allowance when a car to his left pulled away from the curb. He straightened his path so that by the time the car reached him there would be room for it to shoot past between him and the sidewalk. When its whine rose to a thin scream he quickened his pace slightly, still without looking up.

He never had time to look up. Realization that the car was going to hit him sent him leaping for safety, without wasting time looking to assess the danger. He was in the air when the wing of the car struck him a glancing blow. Then he was asprawl on a traffic island, and by the time he turned to stare furiously at the car it was just cutting in ahead of a truck. Far from getting the license number, he wasn't even sure of the color.

Someone helped him to his feet. "Hurt, mister?" he was asked.

"Every bone in my body is broken and I have a bruise the size of a soup plate on my arm," Jacques said violently.

"Oh, that's all right then," said the man, reassured by the vigor of the complaint. Such callousness was utterly inhuman, Jacques thought indignantly.

He limped across the other half of the street, staring balefully at the drivers of car sand trucks, daring them to strike him on the leg with their wings. The only thing that struck him, however, was a sudden thought, and he turned and limped back. His disdain of traffic reasserted itself and he paid no particular attention to the cars flashing past him.

There had been no fuss, no scene. One might almost think that already everyone had forgotten that Jacques Delavonne had nearly lost his life, he told himself incredulously. He found

the place where he had landed and surveyed a few square yards closely.

The fiend in the car had skimmed the island. He could have come no farther over without wrecking his car. And he had been neither passing parked cars nor overtaking anyone else.

"I could almost believe," Jacques told himself wonderingly in his own beautiful language, "that the dirty pig was trying to kill me. But deliberately!"

However, for reasons of his own which he found satisfactory, that couldn't be the case. So Jacques went his way, limping and cursing vitriolicly.

Two hours later he was pushed in front of a train. *Sans aucun doute!* There was such a crush of people that it would be no surprise to anyone that someone fell in front of a train. But Jacques felt the push—a hand placed squarely in his back and a violent shove that sent him flying on to the track.

Given good reason, Jacques could move rapidly. As women's screams tore the air to shreds he bounced on the track as if it were a springboard and dived forward on to the other track, indifferent for the moment about how he landed. When the train shot past him he realized it must have missed him. His hands were dirty and torn, he had scratched his chin, and unspeakable things had been done to his beautiful gray trousers. But he remained in one furious, vengeful Gallic piece.

As the train slowed and stopped

Jacques still heard the screams and shouts from the people on the other side of it. They would think he had tried to commit suicide. He ground his teeth at the injustice of it.

He wasted no time, however, in getting clear of the depot. Whoever had pushed him under the train couldn't make another attempt to kill him while so many people were paying so much attention to what was going on. He saw no sign of anyone following him.

He wanted somewhere to think—somewhere where no so-called accident could happen to him. Apparently he wasn't to be killed openly. Either of the two attempts on his life, if it had come off, would have passed as an accident. He prayed that the same rule would stay in force.

He found a seat in a park, sat down and shook out a cigarette. They were execrable, American cigarettes, but a little better than not smoking at all. He lit it and shuddered.

First, was it settled that someone was trying to kill him? It was. Two such incidents in two hours were conclusive enough for Jacques. Second, who was the murderous fiend? He had not even the germ of an idea. There was no one in the galaxy who could want him dead.

He took the possibility of some extraterrestrial agency first. His father had roamed Hauft and Coutk and a dozen other worlds—he might certainly have had enemies. But his father had died ten years since, and if anyone so hated Henri Delavonne that he wished to kill his son in revenge, why wait ten years? As for his own experience of other worlds, Jacques had been on Mars, Venus and the Moon, but never outside the System. His father, he considered, had done enough pioneer work for ten generations of Delavonnes. And for all Jacques had seen or done on Mars, Venus or the Moon he might never have left Earth. He had seen nothing on Mars but desert, nothing on Venus but rain, and nothing on the Moon but a cabaret that wasn't nearly as diverting as those of Montmartre.

No, nothing suggested itself there. He thought of possible enemies on Earth. He had never swindled anyone because he had never had the opportunity. He had killed or injured no one, not even by accident. And, to his shame, he could think of no angry husbands or fathers who had good reason to remove him from the land of the living.

He must, then, have something or be something that he didn't know he had or was. Either that or he was being mistaken for someone else. But before people made two determined efforts to kill anyone, he thought morosely, they usually made sure they had the right person.

He wondered how far he could trust the desire of his would-be assassins to have his death look like an accident. Were they now prepared to shoot him openly, since they had failed to remove him unobtrusively?

It was all too likely.

"In books," Jacques reflected sadly, "they threaten one with torture and death if one will not tell them what they want to know. One is brave and noble and tells them nothing. But *I* should not be brave and noble. I have more sense, me. Let them tell me what it is they want me to do, or not to do, and I shall do it, or not do it, so quickly—" . .

He sighed. What was he to do now? He could go somewhere else, certainly. But he was a commercial artist and could think of no other way of earning a living.

"And," he told himself moodily,

"though I am not famous, and certainly not rich, I have only to draw a cow entering a field and anyone who is not blind will say 'Morton's Toothpaste!' or 'Shavo Blades!' and I am as good as dead. I could go to the police. They would be polite and say 'But you have no enemies, Mr. Delavonne?' and one would be able to see in their faces they thought I had a persecution complex." He sighed again. "I can only pray to *le bon Dieu*, and I am very much out of practice."

But his prayer was answered. An angel passed him, dropping her handkerchief before she reached him. In very grim tones, for an angel, she told him savagely without looking at him: "Pick it up and be gallant. No one can hear us, but we're quite probably being watched." Then she was past him.

Jacques swept up the handkerchief grandly, took a few swift steps and handed it to the girl. As he bowed magnificently he said softly: "But this is so old. Couldn't you have asked the time, or dropped something other than a handkerchief?"

"Watch what you say," the girl warned him, smiling and tucking the handkerchief insecurely under a bangle. "Someone may be lipreading." At once she went on in another tone: "What a thing to say! And you sound French!"

"Which is not surprising, since I am."

"That makes it worse. So it's all lies about the gallantry of Frenchmen."

"We are realists," said Jacques cynically. "If it were not I who had the opportunity to pick up your handkerchief, it would be someone else."

"And aren't you glad it's you? You apology for a Frenchman. Aren't you even going to walk in the park with me and make immoral suggestions?"

"I'll walk in the park with you," Jacques agreed. "Later I shall decide about the immoral suggestions."

If Jacques had not been expecting to die in the next few hours he would have been enjoying the encounter. The girl was exquisite, and if nine-tenths of her attraction was due to exploitation and effective display, Jacques was not the one to complain. She was a medium-sized brunette and was evidently not of Earth, for she walked carefully as if balancing herself against heavy gravity, and wore a green frock that could have been passed through a wedding ring, though it was a cold spring day. She was dressed for summer and still seemed to find the day rather warm.

As he fell into step beside her she said quietly: "I think we can talk now. Don't move your lips too much or keep them too still. I don't think even a Cout could tell what we were saying at this distance."

"You know that someone is trying to kill me?"

"Yes. I fully expected I'd be too late and you'd already be dead."

Jacques recoiled from her. "That's a nice thing to say to me," he said indignantly.

"You are Jacques Delavonne, of course?"

"I am. I always have been."

"Very well, then. Now don't argue. We've no time. You're in a spot which is liable very soon to be marked X. If you stay still long enough, or start writing anything, or get into any quiet street, or look like getting clean away, the people on your trail will shoot you and damn the consequences. So I have to whisk you away before they have a chance to make up their minds. I take it you don't want to die?"

"You could hardly be more right,"

said Jacques feelingly. "I have never felt less like dying in my life."

"Then I'm taking you to the spaceport. There's a ship for Hauft in eleven minutes, and we're booked. With luck we'll be on it before the Couts realize they're not going to get another chance to murder you quietly."

Jacques said nothing. Hauft was one of the two colonized planets of Vira. Coutk was the other. Put Earth, Hauft and Coutk in one side of a balance, and — in the opinion of Earth, Hauft and Coutk — all the rest of the galaxy wouldn't do anything to bring the other side down. Even a Cout would have agreed that if the hub of the universe weren't manifestly Coutk, it would have been Earth or Hauft. Likewise any Terran would admit that if anything really mattered outside the Solar System, it would be going on at Coutk or Hauft.

"Haven't you anything to say?" the girl demanded.

Jacques threw his hands in the air in an expressive gesture. "She tells me not to argue, and then objects when I don't," he told the heavens. "You say we are going to Hauft. Very well, we are going to Hauft. I have heard of it. It is somewhere outside the System."

It was the girl's turn to be expressive. "The son of Henri Delavonne," she breathed, "and all he knows of Hauft is that it is somewhere outside the System."

"*Chacun son goût.*"

"You needn't think I can't understand you when you talk French. My mother was French."

"Mother French, father Irish, you were born on Mars and have lived outside the System for a long time," Jacques murmured.

The girl's eyes widened. "Ah," she said softly. "I see you are not, after all, as big a fool as you look."

"Never," retorted Jacques, rolling his eyes, "have I received such a delicately-phrased compliment."

II.

The girl's plan worked. One moment they were in a busy street, the next she had dragged him into the city spaceport depot. A rapid elevator descent, a brief subway journey, a dash across the field of the spaceport itself, and they were inside the ship.

"You don't know how neat that was," the girl told him complacently, "but it was neat. I didn't think it would work. I thought any second you'd drop dead beside me."

Jacques shivered. "I wish you'd change the subject," he said uneasily.

"Hurry," said the girl. "Cabin 49. You're now George Steel. I'm Nancy Tremaine. We don't know each other —but meantime you'll have to come to my cabin. We're not safe yet."

"Why don't you speak slowly, one thing at a time?" asked Jacques plaintively. "I'm George Steel, we're not safe, we don't know each other, I must go to your cabin — My head swims."

"Quiet," said Nancy, pushing open the door of Cabin 49. After making sure no one was hiding there, she locked the door and went over it carefully, and when Jacques saw she was looking for concealed microphones, in the best spy tradition, he helped. At least, he tried, but Nancy, on her knees on the floor, hooted derisively. "Would you know a microphone if you saw one?" she demanded.

Jacques was injured. "Certainly," he said. "It's a little flat black thing with NBC on the top."

Nancy had to give up the search for a moment, because she couldn't search and laugh at the same time.

Presently she declared herself satis-

fied. "Now, at last," she observed cheerfully, "the heat's off. For a while, anyway. They couldn't have known about me till I dragged you out from under their noses."

She threw herself thankfully on the acceleration couch, relaxing against the cruel gravity of Earth.

"Now, George," she said, "do you know what this is all about?"

"No."

"You've gathered, I suppose, that it's Couts who are trying to kill you, and that I'm a Hauft?"

"You're no Hauft," said Jacques decidedly. "Haufts are attractive creatures, in an impersonal sort of way, but you—"

"You think I'm pretty?" said Nancy naïvely.

"No. You're very ugly. But you're not impersonal. And you're very obviously no Hauft."

"Pro-Hauft, then. Doesn't that suggest anything?"

Jacques shook his head.

The girl frowned. "It should. Your father knew something which the Haufts could use against the Couts. Well, we're going to need it. Do you know the situation? No, you wouldn't. Well, colonies naturally grow away from their parent country or planet. That's inevitable. Particularly when, as in the case of Haufts and Couts, the colonists in a few generations become physically and mentally quite different from the people of the parent world."

There was a tremor and a strangled sound between a hiss and a distant roar. The ship was taking off. Jacques breathed a sigh of relief. On a spaceship no one could drive high-powered cars at him or push him under trains.

Nancy sank deep into the couch. Her stomach went hollow and she breathed with some difficulty. Jacques,

who had no couch and was still standing, was able to take the acceleration without much trouble.

"Earth has been wise," Nancy whispered, not straining herself against the apparent weight of acceleration. "Things are nicely arranged so that it isn't to the advantage of any colony to quarrel openly with Earth. But between Hauft and Coutk it's different. They're rivals, they're more different from each other than from Terrans, they're close to each other in space, they're jealous, and they're afraid of each other. That's the really important part—their fear. Earth isn't afraid of the colonies, or the colonies of Earth. But Hauft and Coutk—"

"This is a long, uninteresting story without a point so far," sighed Jacques.

"You want me to stop?" demanded Nancy.

"No—just tell me quickly, without the history, economics and anthropology."

"Your father knew both Hauft and Coutk, among other places. And though he died ten years ago, it was only a few weeks ago that Coutk Intelligence found out—"

"Coutk Intelligence? But I thought you represented Hauft."

"If you keep interrupting, George," said Nancy patiently, "we'll never get anywhere. Yes, I represent Hauft. Hauft has an Intelligence Service too, and naturally its main function is to find out all Coutk Intelligence knows, and more. Anyway, as soon as Coutk had this, Hauft had it, too.

"In a letter written twelve years ago to a Cout politician, your father advised his Cout friend to make sure for his world's sake that there was never a Coutk-Hauft war, because he knew of something that would win such a war for Hauft. He didn't say what it was, but he knew it and it was clear from a reference to you later that you knew it, too."

"But this is nonsense!" Jacques exclaimed. "I have never been near Hauft or Coutk."

"Nevertheless, you know this thing, whatever it is, and neither Coutk nor Hauft does. Both Intelligences have been checking carefully since this note turned up. It's clear that your father was quite certain that in any such war the Haufts would win. This letter only appeared when the Cout politician died, but other things found since show that Henri Delavonne didn't want such a war, but knew something that meant certain defeat for the Couts. Anyway, Coutk was sufficiently impressed to deliver orders that you were to be killed, and Hauft to send me to bring you back."

Jacques stared at her in horror.

"Don't you know what he meant?" Nancy asked.

"Of course I know what he meant. But it was only—"

"Don't tell me!" said Nancy sharply.

"But you want—"

"I don't want to know this. Not now. We aren't in Hauft yet. If I don't know the secret, I can't give it away."

"There's no secret!" yelled Jacques. "All that *le vieillard* meant was—"

"Please!" said Nancy, looking exhausted. "Whatever it is, the Couts were trying to kill you for it. Hauft needs it. Maybe it's obvious, but we don't see it—neither the Couts nor the Haufts. And it's no use telling the Couts there's no secret."

Vexation, fear and the ridiculousness of the whole situation gave Jacques the strength of a maniac. He stamped up and down, gesturing, ignoring the heavy pull of acceleration.

Perhaps she was right! Perhaps the

Couts would refuse to believe there was no secret. It was worse than before he knew what this was all about. Then, he had thought he had only to discover what the assassins wanted, and give them it.

"Barbarous! Murderous! Madness! Impossible!" he raged. "Now I, Jacques Delavonne, am to be killed because of a secret that doesn't exist!"

"But you know—?" said Nancy anxiously.

"I know. But what do I know? What is this terrible, secret thing? Nothing! Certainly the Haufts would win this ludicrous, stupid, hypothetical war if there ever was one because . . . no, I won't tell you, you needn't plug your ears. But for all it matters—! I shall suffer this absurdity alone."

The acceleration gradually eased off. Nancy sat up and bounced on the couch experimentally. She was as brisk as ever now that the acceleration was gone.

"Leave that meantime," she said, and jumped up. "There're other things to do. At least, I think there will be."

"What?" asked Jacques suspiciously.

"Never mind. Wait. Sit down, read a book or something. Think of the injustice of it all. Go to sleep. But stay quiet and wait."

Jacques opened his mouth and closed it again. Things like this should only happen to heroes, he thought. He wasn't a hero. He had never pretended to be a hero. And here he was on his way out of the Solar System. Any moment now the ship would deeve and he wouldn't be anywhere. Once they had talked about hyperspace and multiple dimension, but people didn't like words they couldn't understand, and now ships merely deeved.

Jacques had never deeved in his life, and he wished he had never had to. Why, in itself it was dangerous, without homicidal Couts and perhaps only slightly less homicidal Haufts about. Ships deeved and then something went wrong and they couldn't undeeve. Something would stop this ship from undeeving, Jacques felt it in his bones. Or it would undeeve in some utterly unknown galaxy, or in space so far from anywhere that not a speck of light could be seen.

Then he was back on the other train of thought—about the absurdity of it all. Old Henri talked darkly of something that would mean victory for the Haufts in any war against the Couts—and here Jacques was, twelve years later, in danger of his life, over a so-called secret which was as plain as the nose on Nancy's face—very much plainer, now that he had another look at Nancy's nose. She was delightful, but he wasn't going to tell her so. Beautiful women were much better and more interesting companions before you admitted they were beautiful.

Nancy was squatting before a trunk in the middle of the cabin. "I've got a few things for you," she said, "but I only had time to tell a store to send over some clothes for a man."

"Are we still waiting?" asked Jacques.

"Oh, yes. It's better for you not to talk. But I can talk. I don't want to be distracted, but I won't distract myself, you see?"

"I—"

"Don't talk. Would it shock you if I took off my dress?"

"It—"

"I keep telling you not to talk."

Abruptly almost all the remaining gravity disappeared. All that was left was centrifugal force imparted by the rotation of an inner shell of the ship against the outer. It was hardly enough to count as weight, but it did give a feeling of up-and-down. It didn't keep Nancy's dress from floating up to her

waist, but that pressurably didn't matter since she was taking it off anyway. She did take it off. Jacques was half relieved, half disappointed to see that she was still most respectable.

"You see," she murmured, "it's a curious thing about men. They always look at a girl with next to nothing on, even when it's a matter of life and death that they shouldn't."

"Life and death!" exclaimed Jacques, and hurriedly averted his eyes.

"Oh, I didn't mean you."

There was a moment of pain. It was like a blinding flash of light, a clap of thunder, a sudden shock, a searing wave of heat and a dozen other things, all at once. The ship had deeved.

Immediately afterwards there was a knock on the door. "Come in!" called Nancy while Jacques was still speechless after his first experience of deeving.

To Jacques everything seemed to go mad for a few seconds. A man came in, saw Nancy, turned looking for Jacques, and then looked back involuntarily at Nancy. Suddenly there was something in his hand pointed at her. Then he leaned forward and went on leaning, ludicrously, until his face crashed into the carpet.

"Told you," said Nancy complacently. "Shut the door, George, before someone comes along."

In a dream Jacques did as he was told. He looked down at the man on the floor. Nancy was putting something away in the trunk.

"You've stunned him," he said hopefully.

"I did not!" Nancy retorted indignantly. "I killed him!"

It was all too true. Jacques felt the man's wrist, but there was no pulse. He stood up, shaking like a leaf.

"Why, you little killer," he gasped. "I believe you could murder three men a day and not turn a hair."

"I certainly could," she answered grinly, "if they were all trying to shoot me first. Be realistic, George."

Jacques tried to be realistic. It was certainly true that the intruder had been trying to shoot Nancy, and he was quite ready to believe that he was next on the list. If the girl had been even a little shaken—But she was composedly going through the dead man's pockets, examining everything she found.

"You knew exactly what was going to happen," he said accusingly.

"And wasn't it as well I did? He looked slow, perhaps, but I can assure you he was no slouch." She stood up. What little she wore and the things under them, unrestrained by gravity, were doing startling things. "Relax, George," she said. "Everything is going according to plan. Now, once we've heaved him out into hyperspace—"

Jacques dashed through to the bathroom and was violently sick. He had never seen a man die before. But he had an idea that if he hung around Nancy for long he would get used to it.

III.

Nancy had disappeared with the body and the door was locked behind her. Weightless, the body was no more difficult for her to manage than a feather. She hadn't even taken time to dress; no one would be around so soon after the deeve. The man Nancy had killed must have known that. He must have stood outside Cabin 49 and waited for the deeve, knowing he could dispose of Jacques and Nancy and be well clear of the cabin before anyone was about.

But Nancy had been one step ahead of him. Jacques shivered. She was shockingly competent. He knew why the Haufts had sent her—because she

had a Terran competence wholly lacking in Haufts.

That brought up once more the ridiculous business of Henri Delavonne's alleged secret. Perhaps Henri had really pretended it was a secret, to frighten Couts with the unknown. Very likely he was playing one of his deep schemes—

And here am I trapped in it, thought Jacques moodily.

The Haufts were pretty little things. They had wasp waists and long hair much finer than Terrans'. They had little elfin faces; they were cute. They were sweet-tempered, too. Something in the physical change which their world had forced on them had all but cut out anger. Only the Couts were likely to quarrel with them. Only the Couts could.

Hauft was Earth's first and best-loved colony outside the System. Hauft was a favorite child.

"*And that*," said Jacques, kicking the acceleration couch viciously, "*is old Henri's secret*. Name of a name of a name! What can I do with that? What can anyone do with that?"

Henri Delavonne, among many other things, had been a diplomat. He knew how people, groups, countries, worlds would react.

There was no alliance between Earth and Hauft, no agreement, no strong ties of commerce or interdependence or even respect. But if a war started, Hauft would have Henri Delavonne's secret on its side.

Public opinion. Sympathy for the underdog. Bias. Rage at the attackers of the cute little Haufts.

That was all. Nothing to that effect had ever been said publicly—there were no promises, no treaties, no valid reason why Earth should interfere in a struggle so far away, between two independent peoples. But Henri knew it would happen. He had talked about it to Jacques, then a schoolboy, on one of the old man's infrequent visits to Earth. Jacques hadn't been very interested. But what the old man said was clearly true. One couldn't let big ugly brutes like the Couts slaughter the charming little Haufts.

It was sentiment, that was all, and that was why nothing of the sort had ever occurred to the Couts. Probably Earth wouldn't actually interfere, but supplies to Coutk would stop. Merchants who would gladly trade with them would be forced by public opinion to cut the Couts off. And Earth mattered, as far as the other colonies were concerned. Earth mattered a lot. One couldn't afford to offend Earth.

So all the other sources of supply would dry up for the Couts, too. Meantime Hauft would get all she wanted. Gifts, advice, co-operation—in a strictly neutral way, of course.

"I'm sorry for the Couts," Henri Delavonne said once. "They are grim, because their planet is grim; suspicious, because nothing is ever certain on Coutk ; angry, because Coutk is the most infuriating world in the galaxy. They can never be anything else. I understand them and like them, but no one else does. Probably no one else will. What's to become of them I don't know. It's a pity Coutk was ever colonized."

Jacques thought so, too. But he didn't share his father's sympathy for the Couts. "Père Delavonne," he murmured uneasily, "you have a lot to answer for. You invent a secret and die, and your poor Jacques, a simple, innocent artist, minding his business, is left holding the baby. Perhaps *you* could have handled this, Papa Delavonne, but me—I am no diplomat, me, and particularly no hero. I am sick when someone who is trying to

kill me is shot. And when I think of it I am nearly sick again. Why was I not born the son of a painter?"

He was interrupted by Nancy's voice. "It's me, George. Let me in, quick."

He opened the door and she slipped inside and locked it again. There was no sign of the body.

"You might at least have put your dress on," Jacques said.

Nancy smiled grimly. "If anyone saw me lugging a dead body around, it wouldn't matter much that I hadn't. But I'll put something on if you insist."

"I don't care one way or the other," said Jacques hotly. "I'm not in the least interested."

"Well, don't overdo it. The body's gone. Feel better now?"

Jacques, with the body already millions of miles and perhaps a dimension or two behind, found he did feel better. He had reached the stage of being glad that Nancy could shoot faster and straighter than the stranger, and was approaching the point of deciding that it served him right for pushing people under trains. He didn't know how Nancy had managed to dispose of the body, and he didn't want to.

Nancy had put on cool blue lounging pajamas which, rather surprisingly, did no less for her than her last outfit. "Stay here," she said. "I'm going to see if anyone else booked a passage after we did. Don't open the door until you hear my voice."

She was gone, moving gracefully with a sort of slow-motion skating movement. She was apparently used to spaceship conditions. Jacques wasn't. Every movement he made was too violent and he slammed himself against ceiling or walls. That sort of thing could be painful, and his bilingual vocabulary of curses was already exhausted. While gravity hardly existed and falling did no harm, inertia was the same as ever. If one slammed into a wall, mass plus velocity minus only a little for air-resistance meant a thundering good wallop.

He wished he could get another version of Nancy's story. Nancy was beautiful and competent, but he knew of nothing that should make him trust her, except that she killed people who were trying to kill him. That, of course, was something. A certain canny streak in Jacques which hardly anyone ever suspected told him that there were at least a dozen possible explanations of the facts other than Nancy's. He might have been frightened into going to Hauft by two apparent attempts on his life staged by Nancy or someone else on her side. The man she had shot might have been a Terran agent, or a Hauft, not a Cout, and he could have been shot chiefly to stop him from telling Jacques the truth. The so-called secret might be only a ruse to get him to Hauft for some other purpose. Nancy might be a Cout agent—she obviously wasn't a Cout—trying to get the secret from him before killing him.

But if that was so, why had she refused to listen when he was ready to tell her?

"I almost wish," Jacques thought gloomily, "that I had had no father. They would have called me rude names at school, but at least I should not be called to account for Henri Delavonne, who was too much for a poor artist son to live up to. Men like that shouldn't have children."

His reflections were interrupted by the return of Nancy. "He called himself 'Smith,'" she observed. "The captain himself volunteered that he wasn't sure Mr. Smith had actually come aboard. That's fine. When they can't find him they'll assume he wasn't

ready in time, or hopped off at the last minute. This is a Terran ship, George. That's good, too."

"Why?" asked Jacques, bemused.

"Because the Couts will have to be more careful about interfering with it."

Jacques sank weakly on the couch. "Aren't we finished with them?"

"Perhaps. But I'd better brief you in case."

"In case of what?"

"In case we're boarded, idiot!"

Jacques wished he were a woman, so that he could burst into tears. That was exactly how he felt. But presently exasperation stiffened him. "The Couts can't board this ship like . . . like pirates!" he exclaimed.

Nancy looked at him pityingly. "Look, George," she said, "can't you get this into your skull? Hauft and Coutk are on the verge of war—as usual. You know something, whatever it is, which can win the war for Hauft. Naturally Coutk won't even stop at an act of war to kill you. Nor would Hauft to get your secret, probably."

"Ah, I see," said Jacques moodily.

"No, you don't," retorted Nancy irritably. "We're not going to threaten you, or third-degree you, or—"

"Suppose I wouldn't tell?"

"The Couts would still kill you. Your only safeguard is to say what you know. Then there's no point in anyone trying to silence you."

"That would make sense if I had anything to say. But if that's so—why didn't you let me shout it from the housetops back on Earth? That would have served the same purpose."

"Because there wasn't time. The next time the Couts . . . I don't know how many of them there were . . . tried to kill you, they'd have succeeded. They were watching us all the time. If they saw you writing letters or phoning people or talking to

people in the street, they'd have shot you. The only thing to do was what I did. Keep you in the open, so that they'd wait for a better chance, and sweep you off to Hauft before they could even guess I wasn't just an ordinary Terran girl."

"You're very convincing," Jacques admitted, "just like Freud. And Marx—I once read him, too. But though I found Freud and Marx convincing, I wasn't convinced. I am an individual, me. Now tell me—why you didn't let me tell you what old Henri meant?"

"That's easy," said Nancy lightly. "Because, though I think you'll get to Hauft safely, I may not."

She turned away and fumbled in the trunk.

"Who are you, Nancy?" Jacques asked quietly.

"Just a girl," she said, her face still hidden. "A volunteer. You've probably guessed by this time I'm not in Hauft Intelligence. The real spies aren't like me—which is why, I suppose, the Couts at Nark let me get you away."

She looked up at last, her face expressionless. "I haven't said anything about Hauft and Coutk, and the two peoples," she said, "and I'm not going to. People have to make up their own minds. It's no use me telling you that Coutk chills humanity and Hauft nurtures it, so that the Couts and the Haufts are—"

She stopped abruptly. "No, as I thought, I'm no good at making speeches. Come on, let's get back to snarling amiably at each other. Here's the picture."

She went on briskly: "We don't know each other. You're George Steel, and whatever you are you're not French. If the Couts do board us, say what you like make, up your own story, and if there's anyone among them who knew your father, so much the better, for you're not in the least like him. Forget I exist. Now, is there anything else you simply *must* know?"

"Yes. Why should they identify you and not me?"

"They may know me," she said simply. "If so, disguise would be a waste of time. They'll have my fingerprints, encephalograph, measurements, everything. You, no. The first and only order that went out about you was 'kill him.' "

"But—" There were still several large holes in Nancy's story. "Suppose the very first thing they do is shoot you full of truth drugs and ask you—"

"If they shoot me full of truth drugs," said Nancy soberly, "it'll be no use asking me anything. I'm already drugged very carefully and selectively. Other drugs will kill me. And using a mind probe would make my brain collapse. They won't get anything out of me that way."

Jacques refused to think about that. It was unpleasant. He passed on to the one large remaining hole.

"If they think I'm on board ship, how on earth can they be made to believe I'm not?"

Nancy laughed. "Just for a moment, George," she said, "I was beginning to think you were quite smart. You've been asking intelligent questions. But this—really! Why, naturally they'll believe that I got what I wanted from Jacques Delavonne, killed him and dropped him in hyperspace. They can search the ship end to end, and they'll find someone is missing, someone who was aboard when we left Nark and isn't now. Smith."

She grinned at his thunderstruck expression. "Simple, isn't it?" she said.

IV.

Jacques did a lot of thinking in the next forty hours. He hadn't done much

thinking in his life before that; there hadn't been any need for it. Quite early his talent with pencil, pen or brush had been obvious. People would say to him "horse," or rather, "*cheval*," and he would draw a quick, confident line. Though the result wasn't particularly like a horse, anyone who looked at it would immediately think of a horse, and that was what mattered.

At school he had eventually found masters human, after all. For when they found him drawing cartoons of them, they would at first scream "*Barbare!*" and leap in the air with clenched fists—but then they would look again, go away, come back for another look, and finally murmur delightedly: "*En vérité—c'est moi!*"

Before he left college—in America, for his father, now dead, had wanted him to be completely bilingual—a few sketches had appeared in advertisements, signed "Devo." And Jacques continued to be, if not brilliantly successful, at least in no danger of having to work for a living. Drawing, of course, was not work. He would draw even if no one paid him for it.

In fact, to help him to think about Nancy and the Haufts and Couts and Henri Delavonne and the other things, he found it quite necessary to be drawing, and naturally enough he sketched Nancy, from memory.

"Despite the world of detective fiction," he told himself, outlining Nancy's legs, "there are some things which have to be so, no matter how obvious they are." He lost himself a little in that complicated thought, but there was Nancy's figure to keep him on the right track—on some sort of track, at any rate. "Two hasty, ill-managed attempts are made to kill me. And are they practical jokes, *hein?* They are not. If I do not move fast, me, I am dead. Someone, then, has arrived with orders: Kill Jacques Delavonne at once. Then Nancy arrives and says she was afraid she'd be too late. She has just come from Hauft, I think. She whisks me away quickly before the Couts who are trying to kill me—I think they must be Couts, as she says—can make up their minds to do anything."

He had reached a point where it became imperative to decide whether Nancy in the sketch was going to be wearing any clothes or not. He compromised and drew a long, flowing black skirt over shiny white trunks, but not over the slender legs he had already drawn.

"So far, so good," Jacques went on, referring both to the sketch and to his deliberations. "Nancy's story makes as much sense as anything. We are on the ship and on the way to Hauft. We kill this Smith whom the Couts send along with us for company—*pouf!* Now the Couts at Vira cannot know that we are on board this ship—there can be no radio over such a distance, and this ship itself is the fastest way for news to travel. Yet Nancy thinks we may be stopped!"

He drew a pair of beautiful arms. Nancy's arms weren't her best point—they were a little too thin—but mere accuracy couldn't be permitted to spoil Jacques' picture.

"Yes, the Couts might do that," he admitted. "It would be worth a little diplomatic trouble, if there really were such a secret, to make sure that I didn't get to Hauft. She seems to think they may take her and leave me. That, too, is possible."

Emotion shook his hand and he had to take his pencil away from the paper. "Now how can I save myself and Nancy, since no one will believe there is no secret?" he asked. "Can I invent a secret? I am ready to invent anything. Perhaps I should

have a few astonishing secrets ready in case they are necessary. It's a pity I don't know anything about Hauft or Coutk—"

He decided that the skirt and trunks were quite enough for Nancy to be wearing, and took appropriate action with his pencil. The face, at least, he made wholly authentic. There was nothing wrong with Nancy's face. He made her serious at first, but that didn't look right. So he caught her laughing as she had been when he described the kind of microphone he was looking for.

"No," he ruminated, "I couldn't produce an authentic secret. But I can make like an American, and even if the Couts do stop the ship, perhaps I shall be safe. Nevertheless—"

He frowned at the sketch, now almost complete. "Surely no one would destroy a work of art like you, *chérie?*" he asked it. "No, don't misunderstand me. There's nothing personal about it. I speak merely as an artist."

The door opened without a preliminary knock and Nancy shut it carefully behind her. She crossed the cabin quickly.

"Now before the ship undeeves—" she began, then saw the picture. She gave a cry of delight. "Is that me?"

"Frankly, no," said Jacques. "But I admit I took some of the ideas from you."

She held it up ecstatically. "Oh, aren't I lovely!" she exclaimed.

"The picture is quite nice, too," said Jacques sourly.

She put it down reluctantly. "But you mustn't do things like this, George," she told him. "That would give you away at once."

"I know. I just did that because I wanted to think."

Nancy was as pleased as most women with a picture that made her look twice as beautiful as she really was. "Do I really look like that?" she asked wistfully.

Jacques relented. "As far as I can tell. Sit over there dressed like that and I'll tell you."

Nancy laughed. Jacques took up the picture and set his cigarette lighter to the piece. Nancy looked about to cry, so he promised: "I'll do a much better one when this is all over. Only this time you'll have to pose for me."

Nancy, with an effort, became the Hauft agent again.

"I didn't mean to see you again, but it occurred to me that you might write a letter and drop it in the mailbox—"

"Telling someone in Hauft what my father meant? I did that hours ago."

Her eyes widened. "You keep surprising me, George," she admitted. "Now have you been through everything you have in your possession to make sure—"

". . . . There's nothing that suggests Jacques Delavonne? Of course."

"And are you ready, if necessary, to give the whole history—"

". . . Of George Steel? Sure, baby. I guess I may overdo the act a mite, but Couts won't know the difference."

"Well, I don't," Nancy said. "Anything else we can do before the ship undeeves?"

"I can think of a whole lot of things, baby. As for instance—"

Nancy evaded his clutch and made for the door. "I liked you better as Jacques," she said. "But—"

The ship undeeved a little early. It wasn't so bad this time, Jacques noticed. The second time one was aware that it only lasted a fraction of a second, not the eternity it had seemed to be the first time.

"Just as well you thought of those things," said Nancy wryly, "or you might not have had time to do them

now. I'd better get back to my cabin. You don't know me, remember."

She shut the door behind her.

Immediately a ship undeeved, with luck within a few million miles of its destination, its radio call-sign went out. Soon Hauft would know the ship had undeeved safely. Surely the Couts wouldn't dare to stop it now?

"Anyway," Jacques reflected, "they couldn't expect me to be on this ship. The next one, perhaps, if their murderers on Earth failed to kill me and some Hauft agent got me away. No, they wouldn't bother with this ship."

He relaxed a little. "Nancy expected we'd be stopped because she is competent. She thought of it. But the Couts are stupid. The Couts won't be ready. They—"

The alarm bells rang all over the ship. Jacques felt a constriction about his heart. Nancy was right.

The Couts had thought of it.

V.

"In here, sir, please," said the Cout as pleasantly as he could.

The affair had been conducted very neatly, so far. Jacques didn't know what the Couts had told the ship's captain and officers, but the result was that the search was being conducted, on the surface, as an official check—"No cause for alarm, ladies and gentlemen"—like an ordinary customs examination. Perhaps the Couts hadn't even had to make any open threats. The ship wasn't armed; the Cout ship, though Jacques hadn't seen it, must be a battleship of some kind.

When Jacques was ushered into the captain's cabin he guessed that the Couts had collected together all the people who might be of any interest to them, eliminating everyone who was obviously harmless. The captain and three of his officers were there, trying to give nothing away in their manner—they had taken up the role of mere onlookers. There were six Couts in uniform—bull-necked, thick-legged, hairless, their sharp little eyes hiding far back in their skulls. It was out of the question for a Cout after the fourth or fifth generation to pretend to be anything else.

There were seven passengers present, including Jacques. The four men were all between twenty and forty. The three women were two young Haufts and Nancy. The Couts' information or guesswork, Jacques thought uneasily, was surprisingly good. They knew, apparently, what they were looking for—Jacques Delavonne and /or a woman Hauft agent.

"Let me reassure you at once, ladies and gentlemen," said the leading Cout in what was meant to be a pleasant voice, but was too hollow and foreign-sounding to be at all reassuring, "we are looking for two criminals, and no one else here is in the slightest danger. Our examination may be a little inconvenient, and I apologize. But the more freely you co-operate, the sooner we can determine that you're not the people we're looking for, and the ship can proceed."

"May I ask," demanded a tall, explosive-looking Terran, "under what authority you are—"

The Cout held up his hand. "Please don't press the point, sir," he said gently. "Shall I take it that the question wasn't asked?" He stared the tall, explosive-looking Terran down. There was a threat in the Cout's voice and manner that couldn't be read into his words, according to the rules of any court of justice to which the incident might be reported.

Jacques shivered. But he recovered himself and looked at the Terran captain. Having stayed in his cabin

all the time, on Nancy's instructions, Jacques hadn't seen him before.

Captain Fullerton, like most civil spaceline officers, had obviously had a spell in the Terran Fleet. Jacques derived some encouragement from what he saw. Fullerton was angry, and he was well aware of what the Cout intervention actually was—an act of war. He was submitting only because he was responsible for the safety of his passengers and ship. If any chance presented itself, the captain could be counted on for all possible support.

Jacques' gaze passed on to the other officers. Again he was pleased with what he saw. The first officer was raging. One could see that when one looked at him closely. His hands were clenching and unclenching, itching to be at the throats of the Couts. But they were hung about with weapons. The other two Terran officers had better control of themselves, but it didn't look as if they were enjoying the situation or loved the Couts, either.

Jacques was quite unaware that he was examining the situation precisely as his father would have done.

The seven passengers were examined more or less at the same time. The Couts searched them, despite protests, took fingerprints, measured their height, took blood samples, tested reactions and did a dozen other things that might help them or might not. One of the Hauft women objected mildly to being patted all over, and at once was searched far more thoroughly and less considerately. The Couts welcomed the opportunity to make it clear that objections would only make it worse, that refusals would be taken as admissions of guilt, and that anyway they didn't like Haufts. After that they had no trouble. But the captain and his officers looked angrier still.

Jacques suddenly found a pen and paper thrust into his hand with instructions to sign his name. He resisted the impulse to make the signature of George Steel diametrically different from that of Jacques Delavonne, and contented himself with making it obviously not the same writing.

He noticed that Nancy was acting the part of an ordinary Terran girl in such circumstances—interested, unperturbed, wryly co-operative, when in Rome doing as the Romans did, but obviously regarding this as none of her affair. Altogether, Jacques thought, surprised and pleased that he wasn't too frightened, he and Nancy were doing very well and the Couts would soon be satisfied.

Someone shouted something in French in his ear. But the French was so execrable that he found it hard to understand what it meant, and his reaction gave nothing away. Someone else gave him back the pen and paper and asked him to draw a cat. So they knew something about Jacques Delavonne. The heart of Jacques swelled with pride. *I will draw them such a cat!* he thought.

But sanity returned before the pen touched paper and he managed, by thinking of cats and dogs and tigers and cows, to draw something rather ambiguous which might have been mistaken for a cat.

Despite all this he noticed suddenly that the Couts were taking people away one by one. Two men were sent away, with apologies; then one of the women, without apologies. The men were Terrans, but the woman was a Hauft.

And presently only Jacques and Nancy were left.

"I would be obliged," said the leading Cout, Wenkel, to the captain and

his officers, "if you would leave us for a few minutes."

Without a word Fullerton shook his head.

"Very well," said the Cout, and turned to Jacques. "We have identified you, Jacques Delavonne," he said harshly. "We knew at once, but we wanted to make absolutely sure."

One of the Couts had a small machine clamped to the base of Jacques' skull. "He is afraid," the Cout reported. "The fear is growing. It is terror."

"Who wouldn't be afraid?" demanded Jacques shrilly. "This isn't justice. You're pirates, that's all. You board a peaceful ship and say I'm a man I never heard of. You—"

"Would you say," Wenkel asked the captain politely, "that he has a French accent?"

Probably at that moment the captain knew the Couts had found their man. But his expression didn't change. "Not a trace," he said. "He's an Eastern American. I should know."

Wenkel came so close to Jacques that his breath, slightly acrid, mingled with Jacques'. "What is your father's secret, Jacques Delavonne?" he asked softly.

"My father only has secrets from my mother," said Jacques.

"He is less frightened," the Cout behind him reported.

The Cout commander for the first time allowed a hint of doubt to appear in his face. Jacques knew then that he had weathered a bluff.

"Less frightened, when I mention Delavonne's secret," Wenkel mused. "He should be more."

Abruptly, leaving the question of Jacques in the air, he turned to Nancy.

"With you," he said, "it is another matter. I am practically certain I know who *you* are."

Jacques had a sinking feeling. When Wenkel had tried a bluff, he said he was certain. When he said he was practically certain it probably meant he knew.

With deliberate indifference to Nancy as a girl or even as a human being, the Cout prodded her experimentally at the waist with one finger. Fullerton breathed heavily.

"She is no Hauft, sir," one of his men reported, "but she has spent a good deal of her life there. Born on Mars, taken to—"

"I know," said the leader. He gestured.

Jacques had never seen a mind probe, but he could guess what the thing that two of the Couts were taking out of a case was. Their intention was clear. They were going to use it on Nancy, and though they would learn nothing directly from her, they would know indirectly, when she died, that they had been right about her identity. There was no way to stop them using it. The question was, would they use it on him afterwards?

He doubted it. The mind probe, in any case, had serious effects on any brain on which it was used. The Couts would hardly dare use it unless they were sure. They were sure about Nancy. They weren't sure about him. They knew that one passenger was missing, and the missing man might be Delavonne.

They wouldn't use it. They had to be careful what they did to Terrans. Nancy was another matter.

Nancy herself did nothing except look at the mind probe curiously, as if she had never seen anything like it before.

"If you use that, Wenkel," said the captain quietly, "this is not only an act of war, but a criminal offense for which you, personally, will answer."

He didn't elaborate on that. He didn't have to; the simple, plain warning was more effective than any number of threats.

"She is pro-Hauft," said Wenkel, almost defensively.

"This is a Terran ship. And as far as I'm concerned she's a Terran. So if what you say is true, you'll have Earth *and* Hauft on your trail after this."

Wenkel was shaken. Jacques waited, hoping. The Cout leader was obviously balanced between withdrawing altogether and ordering the use of the probe. If he went, Jacques was safe, Nancy was safe, Hauft was safe.

Some things are practically inevitable; big forces over which individuals have little or no control shape events, force them into one particular track. Others, like this, come down to a yes-no decision by one man.

"Carry on," said Wenkel stolidly.

The Couts fixed up the mind probe. The decision was made. Wenkel had been doubtful for a moment, but he wasn't going to change his mind now. Nancy still acted puzzled, as if she didn't know exactly what was going on.

Jacques spoke: "Her brain has been treated so that when you use that she'll die."

They turned to stare at him. For a moment there was a strange look on Nancy's face—vexation, regret, annoyance—the look of someone who had seen an irretrievable blunder being made. But then it softened. She was a woman, after all, and Jacques was making a wild, quixotic effort to save her life.

"Ah," said Wenkel softly. "So you *are* Delavonne."

"It doesn't follow," said Jacques, "but it happens to be true."

"He isn't afraid," said the Cout behind him, puzzled. Pleasure at that

drove the last pangs of fear from Jacques. He became himself again.

"You are wasting your time," he sighed. "Please let Nancy go, those of you who are holding her. And before anyone shoots me, let me fervently assure you that that would do you no good, and me a lot of harm. I have only been running away from Couts on Earth and trying to conceal my identity from you because you are so determined to kill me without giving me a chance to speak. Me, I will gladly tell you all I know."

"My orders," said Wenkel, "are to destroy you at once, not to let you talk to anyone—"

"Even you?" Jacques made a face. "You militarists. System without sense. I assure you, Wenkel, that if you kill me without hearing what I have to say someone will have your head for it."

"You can't treat with them, Jacques," exclaimed Nancy quickly. "They'll listen, then kill us. So—"

One of the Couts struck her with startling brutality. All his hate of Hauft was in the blow. Jacques stared, more surprised than anything else. In his world, such sadism was all but dead. People didn't admire sadists any more.

Something in his gaze communicated itself to Wenkel. He was an officer, after all, and the old tradition of officers and gentlemen died hard. He gestured fiercely, and the Cout who had struck Nancy helped her up. She hadn't made a sound beyond a small gasp, and gave as little other indication of her agony as she could.

Henri Delavonne had been able to handle men. He had got on with Couts and Haufts and a dozen other new races. He had walked all sorts of tightropes and had probably done more in a quiet way to shape the future than any other single man in history—because his sphere of influence was so much bigger. He hadn't been a president, king, general or even explorer, just a sort of wanderer whom people would listen to, or follow, given the chance.

Jacques had never thought it worth while to be proud of him. He would have preferred to be the son of even a bad artist. Anyway, he had never seen much of old Henri. He was more like a distant relative than a father.

Still—Jacques felt a little, just a trace of old Henri in him when he found he had to try to carry on the old man's job. And he noted automatically that one of the Couts had gone. Only five of them—it was a thought not characteristic of Jacques at all.

He told them the truth. Wenkel

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frowned, not believing a word of it. One could see him thinking: "This is just a bluff. Delavonne must think I'm a fool."

"Public opinion," Jacques repeated. "Bias. That's all." He couldn't see how Nancy was taking it, for her eyes were closed. Perhaps the Cout had injured her seriously. Jacques' voice became grimmer. "Nobody loves you, Couts. Your world is hard, and you've become hard, too. Not all of you, I'm told—but most of you. The average Cout is hard and angry and suspicious. And in any quarrel you have, every neutral would gradually find himself against you. You can't help it—"

"This is nonsense," said Wenkel harshly. "If there is no treaty—"

"Naturally," Jacques retorted violently, "if there's no treaty you would assume there would be no help. But you're wrong, Wenkel. Don't you know how strong bias can be? People have been biased against races before, you know. Some great day we'll grow out of it, but we haven't yet. A quarrel between a Cout and a Terran—the Terran must be right. Between a Cout and a Hauft—the Cout's wrong. Between two Couts—they're both wrong. Give people a chance to down Couts, and you know what will happen? Do you know, Wenkel?"

He looked round. Wenkel started to take out his gun.

But Henri Delavonne had been so right. Fullerton brought both fists down on the top of Wenkel's head. At the same time Jacques grabbed the Cout behind him and pulled with all his strength. The Cout shot up to the ceiling and his head crashed into it like a pistol-shot. The first officer, at last, got his chance to seize a Cout lovingly by the throat. The second officer got a judo grip on the fourth Cout, and the fifth was efficiently rabbit-punched by the third officer.

Not to be left out of it, Nancy stooped and caught Wenkel's gun as he fell. She stepped back and looked round swiftly. One of the Couts clawing for a gun abruptly ceased to have any interest in the fight. Another dropped as one leg collapsed under him. The sixth Cout, returning, didn't have a chance to take any part in the conflict. The first he knew of it was a bolt in his chest.

The initial, concerted attack gave Nancy the chance, but it was she, really, who won the short, sharp battle. Hardly any of the others had an opportunity to strike a second time.

The Couts had refused to believe that Terrans would be automatically, unthinkingly, unreasonably, ferociously against them. Now they knew.

Wenkel, disarmed, was covered by one of the Terran officers, while Nancy, her gun steady, kept her lynx eyes on the general situation.

"You see?" said Jacques jubilantly. "That's a good illustration, Wenkel. That's what's going to happen to Coutk if it makes trouble. I'm sorry, but there it is. You yourselves have created the bias against you."

"My men will destroy this ship," Wenkel said harshly.

"Then Coutk will be right in the middle of a war," Fullerton told him bluntly. "Our call-sign has been going out for an hour. There can't be any pretense that we were lost in hyperspace."

Jacques wasn't a good winner. He was dancing about gleefully. "Destroy us if you like, Cout," he gloated. "Old Henri's secret is something you can't destroy. Are you going to let them go, Captain Fullerton? I think you should. Then we can all forget this unpleasantness."

The captain hesitated, then shrugged. "It's your call, Delavonne,"

he said. "Your father used to be one of my heroes. Carry on."

"What your world needs, Wenkel," said Jacques, with sudden inspiration, "is art. I'll go there and start an art academy some day."

Everyone stared at him in astonishment.

"You're mad," said Wenkel.

"If that's how you treat my offer," said Jacques hotly, "you can—"

That was as far as he got.

VI.

Jacques sniffed. He hadn't noticed before that Nancy used perfume. But he knew it must be hers, for it was just right. The back of his head rested on something warm and soft.

He opened his eyes. He was in Nancy's cabin, his head in her lap.

"I didn't know I was wounded," he said, puzzled. He still wasn't quite himself. He spoke in French.

"You weren't," said Nancy. "You fainted."

Jacques sat up indignantly. "*Non, par exemple!*" he declared. "I must have been wounded without knowing it."

Nancy laughed. "We'll give you a medal all the same," she promised. "For gallantry. You saved my life."

He made an expansive gesture. "That was nothing. I couldn't let them kill"—he admitted it at last—"the best model I ever had."

She was, after all, only about three inches from him. He closed the gap.

"So I was only being saved," she said breathlessly, when she could get her lips free, "for a fate worse than death."

"Nonsense," said Jacques. "I want you to be the mother of little Henri Delavonne . . . I think. I'll let you know later." He caught her again.

"Don't you want to know what happened to the Couts?" she murmured in his ear.

"Not in the least."

"You mean that?"

"I'm an artist, not a diplomat. They don't want an art academy. I have already forgotten all about the Couts."

She was laughing helplessly. "Come on," she said, when she had recovered sufficiently to get up. "We're landing on Hauft. Now that it's all over I'll tell you the rest of the story. And show you what a lovely world Hauft is—a paradise for an artist. And introduce you to the Haufts. And tell everyone how brave you are."

"And pose for me," said Jacques blissfully, putting first things first, "in a long black skirt."

EARTHMAN'S BURDEN

All right, *sucker! You won the prize; now you've got to carry it home!*

By MORTON KLASS

Illustrated by van Dongen

HIS first sensation was of lying on something soft; his second was of a bright light close above him, its glare felt even through his tightly shut eyelids. His third sensation was of time having passed—a great deal of time.

"I'm dead," Arthur Morales said aloud, and opened his eyes.

"You *were* dead," a deep, familiar voice answered beside him. "You have been dead for three days, but you are alive now, my friend."

Weakly, Arthur Morales turned his eyes away from the bright light and tried to focus on the furred, grotesque face of Jhumm, the viceroy of the Trogish galactic empire.

"What . . . where—" Morales tried

to sit up, and discovered he was too weak. Numbly, he fell back, and a remembered blackness spread like a blanket over his mind, shutting out the world.

At the final moment of consciousness, he remembered a voice. It was the voice of a human, of a man he respected but whose name escaped him for the moment. The voice said: "*You're a traitor, Morales. The worst traitor who ever lived. You're planning to sell out the whole human race—*"

Arthur Morales shuddered, and buried his mind in the blackness of unconsciousness.

He was alone in the room when he awoke the second time. Carefully, without moving his head more than was absolutely necessary, he stared about him at the room. Although he had never been in it before, his practiced, anthropologist's eyes recognized the furnishings as Trogish, rather than that of the race native to the planet.

Morales smiled wryly. The Earthmen had been here four weeks, and he was the only one who had cared enough to notice the differences. The Trogish liked reds and browns, and sharp-angled, hard furniture. Though their buildings were made of the native iridescent plastic, there was none of the usual coruscation, but rather a sedate nimbus of softened light bathing the abodes of the galactic rulers, and setting their buildings off—for those who had the wit to see—from the gayer constructions of the native San Salvadorans.

San Salvador—Morales writhed internally as he remembered with what pomp Commander O'Fallon had planted the flag of the first interstellar exploration party; with what posturing O'Fallon had named the third planet of Sirius, envisioning himself a second, and greater Columbus! And then the discovery that Earth had not established its first extrasolar dominion, but had instead stumbled on a distant, minor outpost of a tremendous galactic empire!

Cautiously, Morales tried to raise his head. Dizziness swept over him, and he gave up the attempt. What had Jhumm said earlier? *You have been dead for three days—*

It came back to him, then. O'Fallon had shot him. In the back, after that argument in the Earthmen's quarters, when Morales had turned away in anger and announced his intention of going to the Trogish and revealing the plans of the humans. And Pedersen, Morales' best friend, had stood over the dying anthropologist and pronounced the last judgment of humanity . . .

The door in the far wall dilated and someone came in. Even in the semi-darkness, Morales could make out the gangling, heavily furred figure of a Trogish. Amber light blossomed suddenly in the walls, and Morales recognized Kulihhan, son of Jhumm, and the viceroy's only assistant on San Salvador.

"How are you feeling, Arthur?" Kulihhan inquired, bending over him.

Morales smiled weakly. "More alive than dead, I guess," he said. "Where are my friends?"

The young Trogish squatted gracefully beside the anthropologist. "The spaceship of your friends left yesterday," he said. "My father didn't want to put you under the revivifying machines until after they had gone."

He paused, as if debating something within himself. Then he asked, "Why did they kill you, Arthur? You don't have to tell us if you don't want to, but both my father and I are very curious."

Why? Morales knew why, but how do you tell an alien your own kind

have passed judgment on you and booted you out of their species? They'd called him a traitor—good old Pete Pedersen had said it—but he wasn't one yet. His answer to Kulihhan could make him one—it was as easy as that.

But it was different now. It was one thing to watch O'Fallon striding up and down on the packed-earth floor of the San Salvadoran house. It was one thing to hear O'Fallon's rasping, gravelly voice: "I'm ordering you all to be more cautious from now on. That goes especially for you, Morales! You've been spending too much time alone in the homes of the natives, studying their eating habits or whatever—"

"I've been collecting data on the customs of the San Salvadorans! That's part of my job as anthropologist of this expedition. I have to do it alone. San Salvadorans believe in privacy at mealtime, and it's been hard enough for me to get permission to visit them then. They're peaceful, agricultural folk, for the most part. What possible danger could there be?"

"That's just it!" O'Fallon's fear had been in his eyes. "I don't know, and I'd rather not find out! Oh, it's not the native tubs of lard I'm afraid of, but their masters, the Trogish. Those boys control the galaxy, remember, and they had to be tough to do that. We know they've got some fancy machinery—language-teachers, antigravity rafts, and the like. Probably a lot of stuff we haven't seen yet."

O'Fallon had paused and gestured for the men to gather close around him. "Look, men—we'll be leaving in a couple of days. We've got to go back to Earth and warn them what the human race is up against—"

"And just what is that, commander?" Morales had wanted to know.

"A galactic empire, you fool! A super-race that thinks it can relegate Earth to the position of a tenth-rate possession!"

Oliphant snickered.

Commander O'Fallon nodded approvingly. "That's right, Harvey—they'll have another think coming in a few years. But we've got to be careful. The Trogish are older, and more advanced, than we are. Probably more numerous, too. And if any of their subject people are willing to fight for them—"

"Wouldn't worry about that," said Oliphant. "From what I could see, the Trogish have to do all the work themselves. The San Salvadorans won't help any more than they have to. The natives raise their crops and work a few hours a year in the factories. The rest of the time they play their weird music or sculpt or sit around and talk. Jhumm and his son handle all the planetary and interplanetary distribution. But the Trogish'll be trouble enough, when it comes to a fight."

"I wouldn't be so sure of that," Pedersen put in thoughtfully. "I've talked with a couple of San Salvadorans, myself. You hear about the trouble the Trogish have keeping to a shipping schedule? Or about the way they loused up last year's building project? Seems that Jhumm, the big cheese around here, forgot to—"

"What are you getting at, Pedersen?" O'Fallon demanded impatiently.

"Why, just that the Trogish are incompetent," the geologist told him. "If they mess things up that way in peacetime, they would probably do the same in war. You know—mixups in ammunition shipments, warship equipment in need of repair, and so on. It figures."

Kulihhan broke in suddenly on

Morales' thoughts. "From your silence, Arthur, I assume you would prefer not to answer my question."

Morales focused his eyes on the furred face of the young Trogish. *Answer the question,* he thought. *Tell him the other humans went home to prepare Earth for a war for the Trogish. Tell him you were opposed to the war, so O'Fallon shot you.*

The anthropologist cleared his throat uncertainly. "It . . . it's not an easy question to answer, Kulihhan. I broke some important rules of human behavior, so they killed me."

Kulihhan waved a four-fingered, furred hand deprecatingly. "Oh, I understood that, of course. It was obvious they didn't kill you for the amusement your death might afford them. But why punish you that way? If you committed some infringement on the human code, wasn't it apparent that you were in need of either instruction or treatment, depending on whether you were aware of what you were doing or not? Destruction, after all, is such a waste of a sentient creature—"

Morales shrugged. "It was a pretty serious infringement, I have to admit. Look, Kulihhan, could we talk about it tomorrow? I'm getting sleepy again."

The Trogish rose to his feet immediately. "Forgive me, my friend. I should have remembered how weak you are."

He started for the door, then stopped. "My father asked me to apologize for him. He couldn't drop in to visit you this evening because of his work. But he hopes to have a free day tomorrow, if he can get everything cleared up tonight, and he would like to spend it with you, if you feel up to it."

Morales nodded, and Kulihhan went out, dimming the lights behind him.

The anthropologist sank back and closed his eyes wearily. He knew that for the hard-working Trogish, a day off was a jealously guarded thing. For ten San Salvadoran days or more, Jhumm would spend long hours supervising quotas of food and machinery production, attempting to meet both the needs of San Salvador and the other planets in the galaxy. Then would come the one day on which Jhumm could sit in the garden with his wire scrolls and his computers and pursue his favorite subject, a development of the unified field theory which none of the humans had been capable of comprehending. Kulihhan, too, cherished his rare workless days, for he was a poet, though the language machines, which had given the humans as complete a knowledge of Trogish and San Salvadoran as it had given the Trogish a knowledge of English, hadn't been able to pass on sufficient understanding of Trogish symbolism and abstraction to make their poetry comprehensible.

And yet here was Jhumm prepared to give up his precious day to the company of a human!

The more he thought about it, the more Morales was convinced that Pedersen and O'Fallon and the rest were wrong: the Trogish were not just a conquering race, as the Persians, Romans, and Zulus had been on Earth; there was something more to the Trogish overlordship of the galaxy.

Morales believed that now. It was not uncertainty on that score that had made him give Kulihhan an equivocal answer, but a desire to think matters out more carefully before he made the final, irrevocable, treasonable announcement to the Trogish. For one thing, how would the Trogish react

to the news that the barbarian newcomers on Earth planned to challenge their hegemony?

Superior race though the Trogish might be, their only answer might be to destroy the upstart planet. Morales doubted that: Kulihhan's comments on execution might certainly be considered proof enough of the Trogish attitude, but Morales had to be sure.

It was bad enough that the humans had been so positive of the logic of their own position. There was the argument which had preceded his death—

"The Trogish had it too good for too long," Pedersen pronounced flatly. "They've grown soft. Now it's our turn."

Morales stared at his friend with contempt. "You're going to cheer for the greater glory of the Earth empire?" he demanded. "What's happened to Pete Pedersen the pacifist? Back in college you used to say, 'War is evil. Nothing can be achieved by beating somebody's brains in. If might doesn't make right in personal matters, it certainly doesn't in international affairs—' "

"This is different, Artie," Pedersen interrupted. "Humans shouldn't fight each other, but that doesn't mean they should knuckle under to aliens. And I refuse to shed any tears for the Trogish. They're arrogant—they treat the San Salvadorans like inferiors, refusing to give them any say in their own government or even in their own economy. The Trogish are conquerors, and the only future for conquerors is to be conquered in turn.

"Besides, I don't think an Earth conquest would be so bad for the galaxy. We're not what we once were. I'll bet that a triumphant Earth would teach formerly subjugated peoples like the poor benighted San Salvadorans to stand up for themselves. There's no reason why an Earth-directed confederation couldn't be based on democratic principles."

"With men like O'Fallon here in command? You know very well he's thinking about the loot he can drag home. You're a bigger fool than he is, Pete!"

"And what are you, Morales?" Commander O'Fallon asked evenly. "Pedersen and I may not agree on every point, but we know which side we're on. Which side are you on, Morales?"

Arthur Morales took a deep breath. He was surprised to discover that his forehead was bathed with perspiration. "I'm not on anyone's side," he said slowly. "I don't see why there has to be sides. Commander O'Fallon, if this is a scientific expedition—as it set out to be—you have no right to force me to make such decisions. I'll take your orders in times of danger, but I'm not a soldier or a spy or an empire-builder. I intend to conduct investigations which are in accordance with my field of science. That's all I am qualified or commissioned to do, and that's all I care to do."

"In other words," Oliphant said, "you're agin' us."

"If it comes to that—yes!" Morales couldn't stop the words rushing from his lips, and suddenly he realized that he didn't want to. "I'm against conquest; I'm against destruction—and I don't care who's doing it! There's no reason to believe that a Trogish galactic empire means what it would mean in Earth terms. Maybe it's to the advantage of Earth to submit to the direction and leadership of a more advanced people. I don't know—but I do know that I'm not going to help you start a war with an unoffending race! If you go back thinking the way you do, you'll incite Earth to war!

There'll be no backing out, nothing ahead for the whole human race but—"

"And just what do you intend to do about it?" Commander O'Fallon asked.

"I'm going to see Jhumm!" Morales snapped. He turned on his heel and started for the door. "I'm going to warn the Trogish that there are barbaric Earthmen on this expedition who can only think in terms of bloodshed. I'm going to ask them to help me stop you, and to get some sort of sane message back—"

Morales had just reached the doorway when he heard the explosion. Absently, he stared at the rotund San Salvadoran sculptor on the other side of the wide dirt street, who was crawling like a red slug over an unfinished, nonobjective granite statue. The anthropologist's knees grew numb as he tried to comprehend the smashing blow on the back he had just received. He stumbled and went down, twisting so that he landed on his back.

The pain increased agonizingly, and so did the numbness. It seemed to be affecting his vision. He could barely make out the smoking pistol in O'Fallon's right hand.

"You . . . shot me—" he whispered, striving to understand, and bitterly unhappy that he could not.

Pete Pedersen stepped forward and stood over Morales. His voice came thinly over the black gulf that had suddenly opened up before Morales' eyes. "You're a traitor, Morales. The worst traitor who ever lived. You're planning to sell out the whole human race—"

Morales twisted on his narrow cot in the Trogish viceroy's spare room. He moaned and threw a weak hand up over his eyes to shut out the dim light and the accusing voice in his mind. The arm brushed wetness, and he knew that he was weeping.

Jhumm was waiting in the garden when Morales came out the next morning. The anthropologist had awakened to discover a bowl of food beside his bed. He had an appetite too, he was pleased to discover, and when he had finished the oatmeal—could it have been that?—he felt strong enough to get out of bed.

The Trogish was listening to a scroll and clacking away at the keys of his computer, but he removed his earphone and looked up courteously when Morales appeared in the doorway.

"Ah, my friend," Jhumm said, rising to his feet, "I see you are recovering from your illness."

"From my death, you mean." Morales stepped to the side of the Trogish and breathed deeply of the perfumed, warm air. "It's good to be alive again. Jhumm," he went on awkwardly, "I don't know how one expresses gratitude for what you've done for me."

Sure you do, Morales told himself silently. *Just tell him why they killed you. Anybody would consider that payment enough.*

Jhumm raised a protesting hand. "Please, my friend! There is no need to thank me. I am most happy the revivifying machines did their work properly. We Trogish are not good mechanics, you know. Two hundred robots are out of commission on our north continent spaceport. Everything is in chaos up there—but enough of this!" He put a furred arm around Morales' shoulder.

"You are alive again, my friend, and I have a free day, and this is after all a period of rejoicing for all the

Trogish in the galaxy who can spare the time from their work!"

"Rejoicing? Why?"

Jhumm's wide-eyed face registered surprise, and he was about to answer when a rotund San Salvadoran waddled into the garden.

"Greetings, Jhumm!" the red-skinned, hairless creature pronounced, raising a double-jointed arm. "I understand that all went well with the Earthmen. I have come to proffer my congratulations!"

Jhumm wiggled his flopping ears happily. "Thank you," he said. "And my thanks, too, to all of your people for bearing with us so patiently in these last difficult years."

Morales was startled. The San Salvadoran was speaking in the Trogish language, and Morales had assumed up until now that no native was capable of that feat. At least, none had ever attempted it before in the presence of any Earthman. Oliphant and the others, as well as Morales, had remarked on the studied San Salvadoran indifference to their rulers. In return, the Trogish had always treated their subjects with a dignified reserve, speaking to them only when it seemed absolutely necessary.

And now here was a San Salvadoran speaking Trogish, and Jhumm was wriggling with happiness!

A sudden, irrational suspicion burgeoned in the anthropologist's mind. "Jhumm," he said, stepping forward, "do you know why I was killed?"

The tall Trogish turned. "To prevent you from warning us of an impending attack by Earth, of course."

Morales swallowed hard.

"You knew that?" he whispered. "And yet you let them go?"

The San Salvadoran waddled to Morales' side. He looked up at the human earnestly. "You must not grieve over that which cannot be changed, human," he said in his own sibilant language, and Morales became more confused than ever.

For four weeks the humans had tried in every conceivable way to get on speaking terms with the natives. But the San Salvadorans had answered every inquiry as briefly as possible and then returned to their own pursuits. It had been decided, finally, that the San Salvadorans were either too bucolically stupid or too subjugated to be able to respond intelligently. But this native, for some obscure reason, was offering his sympathy to Morales!

Then, suddenly, the anthropologist became aware that Jhumm was speaking.

". . . We didn't exactly know why they'd killed you, yet it wasn't hard to figure out. We were quite certain O'Fallon, your commanding officer, disapproved of the Trogish empire and had dreams of destroying it. When he killed you, the inference was that you refused to go along with him."

The tall Trogish played absently with the keys of his computer. "As for our letting them go, knowing they planned to persuade Earth to attack us," he went on, "I'm afraid I have a confession to make. Not only have we been aware of this plan, but we've been hoping desperately that nothing would happen to change the Earthmen's minds!"

"But . . . but why? Earth *will* attack, you know. They'll be back just as soon as a warfleet can be constructed. Unless you think your empire is impregnable—"

"Oh, don't worry about that," Jhumm said airily. "It's not. Our warships have been rusting hulks for almost a thousand years, and we probably couldn't operate them properly even if we knew how to put them

back in shape, which we don't. No, Earth will attack us, and that will be the end of the Trogish empire, and I thank the ancient gods of my people that I am alive to see this happen!"

The San Salvadoran whistled with amusement. "I appreciate how you must feel, Jhumm. And speaking for all of us on this planet, it couldn't have happened to a more deserving race!"

Morales clutched a throbbing head. "I don't understand," he muttered.

In a patient, almost lecture-room tone, the Trogish went on. "For close to two thousand years, Arthur, the Trogish have administered to the needs of the galaxy. That's long enough. We've paid our price of admission to the status of a mature, civilized race. We want to be able to concentrate at last on the more important things—basic philosophy, the arts, science, and the general ordinary enjoyment of living. A race which has to worry about the multitudinous details of a three-billion-planet galactic civilization just hasn't the time for those things. I want to be a mathematician—and it looks like I'm going to get the chance!"

"But there will be bloodshed . . . warfare—" Morales protested.

"Not if we don't put up a fight," Jhumm told him. "And we won't. Nobody will. As soon as the Earth warships appear, we'll surrender and turn the reins of galactic rule over to them. Then we'll go about our own business, and let Earth run things, while we sit home thankfully on our own world. That's what the Pikux did to us, and before them the—"

"You mean the entire galaxy will just relax and allow Earth to take over?"

The Trogish viceroy wiggled his ears contentedly. "That's right. The galaxy is a smoothly running affair, you see. All it needs is a few individuals on each planet to keep things moving. Isn't it fair that the youngest, most backward species be given the job? After all, someone has to do it, and the older races obviously can do much more important things. Besides, it helps the newcomers to mature. After a few centuries, they begin to realize that what they thought was an empire is more on the order of being interstellar bookkeepers and clerks. But they weren't forced into anything—they demanded the job, and now they're stuck with it."

Morales began to chuckle crazily. "What happens if they up and quit?"

"They won't. None of us do. By the time they realize it fully, they've matured to the point where they can accept their position at the bottom of the galactic heap. Then it's a matter of waiting for a new race to come boil-

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ing up off a planet, demanding control of the galaxy."

"So for the next thousand years or so, Earthmen will be nothing but administrators, technicians—janitors?"

The San Salvadoran rippled its skin sympathetically. "Yes, human, that is the way it must be. The rest of us will help out occasionally, after a while, but only if we want to."

A thought occurred to Morales. "What happens to me?"

"That's up to you," Jhumm told him. "I'm afraid we can't permit you to meet up with Earthmen again. Not because we want to keep the future a secret—they wouldn't believe you, anyway. But because you're supposed to be dead, and they'll get curious about the revivification process. They'll learn it eventually, of course, but there's an established pattern to galactic conquest, and we mustn't disturb it."

The Trogish stared down at his computer thoughtfully for a moment. "How would you like to travel about from planet to planet on the supply ships, visiting the different peoples? Every planet has its own culture, you know, and they're all interesting."

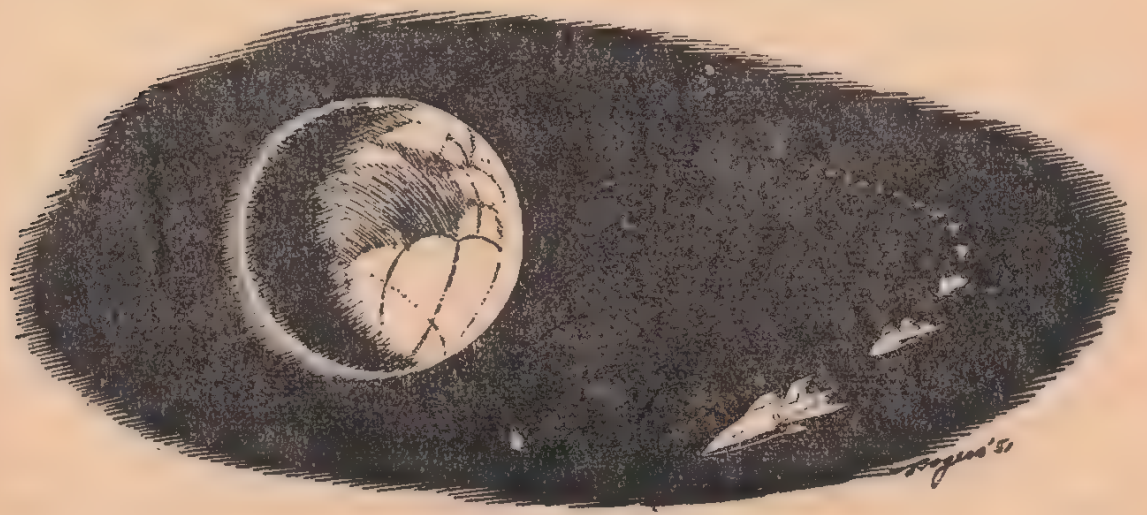
The young anthropologist nodded violently, so overwhelmed that he could not speak.

"You would? Good! It would take more than your own lifetime, even if we extend it to the full limit of our ability, to visit them all. It will even be many hundreds of Earth-years before full Earth administration is established over the entire galaxy. The Trogish will have to maintain interim control until then, but as long as it's interim, we won't mind."

"Oh, that reminds me!" the San Salvadoran broke in. "The planting season for this continent is upon us again, Jhumm. How many fields of *shasiss* beans are we to set our robots to planting this year?"

"My son is working on that problem right now," Jhumm said. "He will announce the quota as soon as he knows the figures himself." He pointed at the half-dilated door of the house, through which Kulihhan, the assistant Trogish viceroy on San Salvador, could be seen dimly, working furiously at his desk, almost buried beneath a mound of papers.

THE END



TORNADOES AND ATOM BLASTS

By J. O. HUTTON

We had some peculiarly vicious weather last summer; we also had a long series of atomic tests in the western desert areas. Nobody knows whether there was a connection or not—but here are some highly interesting and cogently organized facts on the subject.

DURING the first six months of 1953 two major news events occurred in such close time proximity that it was inevitable that a technically conscious public should begin asking if there might be some connection between them. One was the series of atomic explosion tests at Yucca Flats, Nevada, conducted by the AEC and the Armed Services, and the other was the record crop of tornadoes and other freak weather which plagued most of the eastern half of the United States.

By the middle of June the total number of tornadoes to hit this country was reported by the Associated Press to be well over two hundred fifty, the highest previous count being one hundred ninety-five for a five-month period in 1933. The twisters slaughtered over two hundred fifty people, over twice the national average, and left numerous casualties. The property damage ran into hundreds of millions of dollars. New York State recorded a record March and April rainfall, and large hailstones fell in territory where people could not recall ever having seen such weather before. Radioactivity was present in abnormal quantities in some of the most freakish precipitation. But these figures do not reveal the whole story.

The Mississippi Valley and the plains states of the Midwest are the usual breeding grounds for large tornadoes, and this year the great monsters visited two Eastern Seaboard states, Georgia and Massachusetts. The damage summary was roughly twenty-one deaths and sixty-five million dollars property damage in Georgia, and eighty-five deaths and seventy-five million dollars in Massachusetts. Ohio, Michigan, and Alabama were also severely damaged.

My personal interest in meteorology is primarily the practical approach of an aircraft pilot who has flown airplanes over most of the United States and the Pacific Ocean, and is interested in surviving to an old age. Experienced pilots respect the weather, because they know it can be their most dangerous adversary. Their best tool for survival is knowledge ; practical knowledge. This is said as one who has stuck his neck way out, on occasion,

by flying into unknown weather conditions on nothing but the meteorologist's say-so, and who has learned—sometimes the hard way—that theoreticians do not yet have *all* the answers to weather phenomena.

Soon after the weather records of many eastern states had been broken, the public apprehensions were quickly allayed by virtually all the news agencies, who quoted official spokesmen for the AEC and the Armed Services, as well as private scientists, to the effect that the atomic explosions could have absolutely nothing to do with the freak weather. A few of the distinguished gentlemen quoted were somewhat more circumspect, but the general impression left with this writer was not entirely that of the open-minded, objective attitude he has come to associate with Science—but perhaps more that of a skeleton being hastily shoved into a closet.

Sure, we've had tornadoes and freak weather in many of the past years, and we'll no doubt have them in future years—but a good many weather records were broken this year in a three-month period, and *something* caused it. Certainly the atomic explosions cannot be responsible for *all* this year's freak weather, because we have a certain amount of that *every* year. What I refer to here is a matter of degree rather than of kind. At any event, technical men, while quite willing to render due respect to Authority, seem to prefer to also examine the evidence for themselves! Accordingly I intend to present some facts now available, most of which can be easily checked by any independent investigator. It seems desirable, however, to first go back a bit and outline the subject for those not already familiar with it.

Of all the events in an eventful nature, perhaps the most terrible to onlooker and participant alike, is the tornado! Like lightning, it is compounded of awful power and seeming caprice, but the sheer power contained in the tight, roaring vortex of the tornado is many times greater than a lightning bolt; greater indeed than an atom blast. Its destructive effects may be low comedy, or pure tragedy. It may strip all the bathroom walls from about an unsuspecting bather, and leave him unharmed—or again it may decapitate a man's wife before his eyes, as happened this year.

It has been known to drive wheat straws deep into a hardwood tree trunk, or utterly demolish half a town and leave the other half standing unharmed, as it did Danville, Indiana in 1948. Buildings hit by the center of the vortex literally explode due to the sudden drop of outside air pressure. The higher wind velocities, and their sudden changes of direction, cause greater destruction within a small area than is ever perpetrated by a tropical hurricane.

Tornadoes are known to occur in many parts of the world, but they reach the zenith of their strength and power in what seems to be their natural haunts, the plains of the Midwestern States. This is, of course, no statistical accident. The entire configuration of the United States and its surrounding gulfs and oceans contribute to the phenomena. It can be said that tornadoes *always* occur in conjunction with a thunderstorm—technically cumulo-nimbus—cloud system, as does large hail; so tornadoes and hail, as well as heavy cloudbursts, are different effects of the same cause. How they come about will be brought out in the following discussion.

From a generic standpoint the tornado is related to the tropical hurricane, in that they both are counterclockwise—in the Northern

Hemisphere—vortex systems, which derive their life and energy from release of the energy stored as latent heat of evaporation in a warm, moist, air mass. If they were viewed from directly above, a cross section of either would appear as a circular, rotating, dynamic air mass system, the centrifugal forces on the air due to the rotation being exactly balanced by the pressure gradient directed towards the center of the storm.

The hurricane is an extensive system, covering perhaps a third of a million square miles of the Earth's surface, while the tornado is a compact funnel or tube generally only a mile or so in diameter, and far from stable about its vertical axis. The hurricane is formed only over the oceans and in the lower latitudes—ten to twenty degrees as a rule, since the Coriolis component of acceleration is negligible there, while the tornado commonly occurs in the middle and even upper latitudes. The tornado occurs both over land and sea, but is strongest over land. The hurricane exists at full strength for any appreciable time interval only over the sea, and dies down if its path leads over a large land mass.

Most of the foregoing is simply general background, but the reader may have already gathered that the behavior of thunderstorms is the key to understanding and analysis of the freak weather. The reason for this is that a fully developed thunderstorm releases a large amount of energy within the confines of a relatively small region of space, and moreover does it rapidly. If this energy release per unit of space, or per unit of mass of air, occurs at an abnormally rapid rate, then we have freak weather of some sort. For example, it has been calculated that the heat released by condensation which produces an inch of rainfall over a square mile would be equivalent to roughly sixty million horsepower hours.

Under certain conditions on the East Coast a slow drizzle may require forty-eight hours to deposit one inch of precipitation—but again the whole inch may be dumped as large hail in ten minutes. In the first case it'll be good for the flowers, and in the second it'll break a lot of windows, but assuming all other factors constant the same total amount of energy has been released in both cases. Thus it seems expedient to by-pass, in so far as possible, the main body of Technical Meteorology, and concentrate on the rapid processes.

Before we get on to thunderstorms, however, it might be well to examine briefly the mechanism by which energy is stored in an air mass, and what happens when it is released, as well as the factors which make an air mass stable or unstable.

To be a bit more specific about the above, each gram of water that changes state from liquid to vapor requires some six hundred calories to bring about the change of state without raising its temperature at all. The water vapor then supplies part of the pressure in an air-water vapor mixture, and the water vapor, if again condensed, will return six hundred calories per gram to the air. Since energy can be neither created nor destroyed, part of the heat released will be used to raise the temperature of the air, and the rest will be used in performing the work of expanding the air due to the heating. The practical consequences of this process are extremely important to weather phenomena.

If we consider a parcel of dry air to follow an Adiabatic Process—i.e. no heat added to or taken away from

the parcel during the process—and lift it by some means, we find that the temperature decrease is 5½ Deg. F. per 1000 feet of lift. Lower the parcel and the temperature rises at the same rate. This is the process of

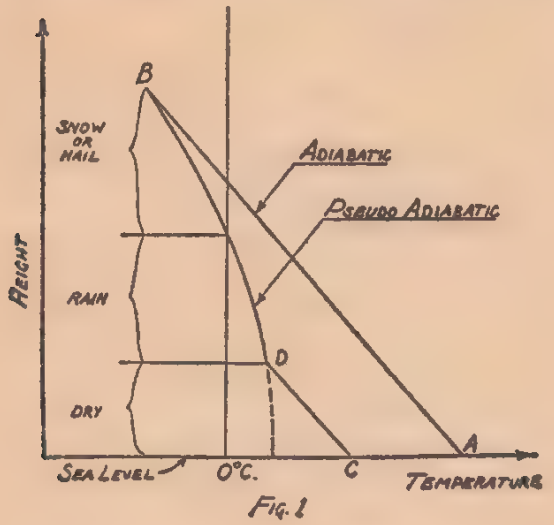


Fig. 1

curve AB in Fig. 1, and under these conditions the status quo is pretty well preserved and nothing much happens—but, if the parcel of air is loaded with water vapor, the process becomes more complicated. Such a process is represented by curve CDB in Fig. 1.

Initially the parcel may cool at the Adiabatic Rate, but at some point in the lifting, depending on the Relative Humidity, the Dew Point will be reached, as at point D of Fig. 1, and the cooling rate then becomes Pseudoadiabatic, or Moist Adiabatic, as water vapor is being condensed out of the parcel, with heat consequently being added to it. To follow it through, if the originally moist air parcel is then returned to sea level, it will follow the curve BA, and its temperature will be increased from C to A.

Now suppose a balloon carrying automatic recording instruments is sent up, as they do regularly at most of the United States weather stations. We can obtain from this, among other data, a plot of the actual Temperature vs. Height for a given time and position, which is called the Lapse Rate. For simplicity assume that the Lapse Rates for two different air masses are the straight lines A and C of Fig. 2, where a portion of the moist adiabatic curve BD of Fig. 1 is included (shown dashed). The air mass having the lapse rate A is stable, since if a parcel of air is mechanically displaced upward—assuming both air masses already saturated—it will follow the curve BD and become colder, and hence denser, than the surrounding air and tend to settle back down. The lapse rate C, however, indicates instability, since upward displacement of an air parcel will make it hotter than the surrounding air, and the parcel will continue to rise like Lavoisier's big hot-air balloon as long as these con-

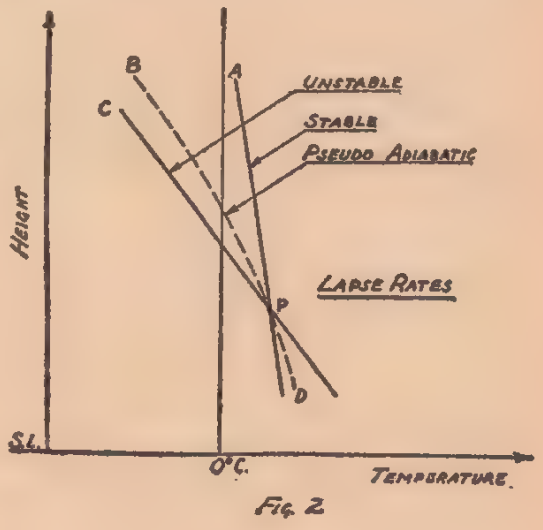


Fig. 2

ditions hold, shedding first rain, and then snow or hail, depending upon speed, turbulence, and the temperature of the ascending air. If the parcel of air must be lifted by mechanical means for an appreciable distance before it becomes unstable,

·t is known as Conditionally Unstable, and this is in general the condition of potentially unstable air masses, since as soon as a parcel becomes unstable it rises and cold air rushes in to replace it, turbulent mixing takes place, and stability is restored.

In nature, the mechanical lifting necessary to trigger instability in a conditionally unstable air mass may occur in any of several different ways, or combinations of these. The sun may heat the ground sufficiently to cause ascending currents of air which provide the trigger action, or the whole air mass may move over high ground which lifts it, or a fast moving body of colder air may drive under the conditionally unstable mass and lift it like a wedge. This last agent is known as a Cold Front, and may extend laterally for hundreds of miles, causing a long line of thunderstorms known as a Line Squall.

The cold front, since it moves at velocities of up to 60 mph, has a steeper slope than other moving air masses, and the line squalls are generally the most severe thunderstorms of all. When the cold front runs into a range of high mountains a double lifting effect occurs as the warm air mass is squeezed between the two. I ran into such a storm over the High Sierras at night once, by mistake, and even though an immediate one hundred degree turn was made, both my passenger and I were shaken like dice in a cup, and the steel antenna for the radio was snapped off. Either a Line Squall or an extremely severe Air Mass Thunderstorm are the only logical breeding places for a tornado, as will be described later.

Now that some of the basic mechanism that operates a thunderstorm has been described, we can identify the air mass most likely to produce thunderstorms. It will have high humidity, and an unstable, or conditionally unstable, lapse rate. The type of air mass usually meeting these specifications is formed over the Gulf of Mexico, where the body of air takes on the characteristics of the surface over which it passes. This air is so humid that moisture is generally visible in a fairly stable colloidal state known as Cumulus Clouds.

Sometimes these clouds are so thick that they appear from the ground as a thick strata, with the cloud bottoms flattened by the flow of the air mass over a colder strata of air next to the ground. To a pilot flying "on top" however, they appear as great puffy cauliflower masses rising like castles to great heights. When the thermal energy contained in these clouds is triggered, they become cumulo-nimbus, or thunderstorm clouds, and the top becomes crowned with a filmy cloud of ice crystals, which is roughly anvil shaped. The height of this ice cap is a good practical indication of the strength of the storm, and usually will be at fifteen to twenty thousand feet.

In the case of the particular storm mentioned previously, I tried to fly over it at seventeen thousand five hundred feet the next day and found that the top towered over the ship by at least that height again. Fig. 3 is a diagram of the lateral cross section through an air-mass thunderstorm. The arrows indicate vertical flow of air, which sometimes causes turbulence so great that it has been known to break the wings off aircraft.

The greatest turbulence designated by T in the diagram is in the forward part of the storm, and is the probable birthplace of the Tornado. In an

extremely large air-mass thunderstorm, or a line squall, the horizontal curvature of a horizontally rotating vortex of air would be small, and the frictional forces on such a vortex would be relatively large, so that precession would occur, as in a rotating gyroscope wheel with bearing friction. This could conceivably cause one end of the whole rotating air body to swing down and form the usual tornado vortex. The vortex then maintains itself for a while in the vertical position by virtue of the heat energy released from condensing water vapor.

As far as the eastern half of the United States is concerned, the two principal air masses which make up the weather are: cold, dry air masses which flow down from Canada and the Polar Regions, and warm, moist air masses from the Gulf of Mexico. Both of these air masses come together and are then deflected eastward somewhere over the middle of the country, and the ensuing dynamic mixing causes storms and other weather. Occasionally an air mass moves in from the North Atlantic and brings a spell of cold drizzle. These air masses are seldom more than about fifteen thousand feet in depth. The Winds Aloft—those above fifteen thousand feet—almost always blow from West to East.

The Japanese in World War II were able to harass our West Coast for months with nothing more complex than cheap paper balloons loaded with incendiary bombs, which were presumably released in Japan and left to the prevailing winds to do the rest. These devices floated hundreds of miles past the coast line and kept the fighter commands and civil air patrols quite busy. With regard to this discussion, the practical effect of this meteorological condition was to take the radioactive products of the atomic test explosions which reached the upper atmosphere and broadcast them over the eastern half of the country.

Now it might be well to take an-

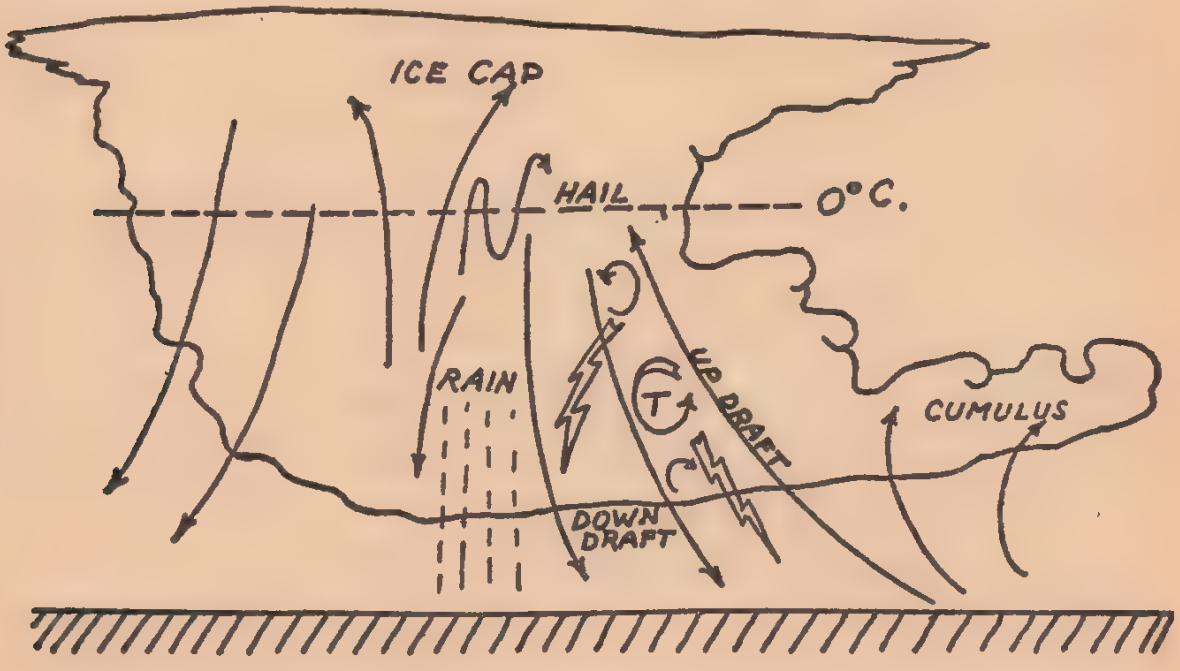


FIG. 3

other look at the total energy of a hypothetical air mass. Suppose that the average water vapor content is sufficient to deposit two inches of rainfall over the entire area beneath the air mass, and that this air mass is circular and one thousand miles in diameter. These figures are quite possible. The equivalent energy per square mile computes out to roughly one hundred twenty million horsepower hours, and the total area is approximately seven hundred eighty-five thousand square miles. Multiply the two figures and you have a large quantity indeed! One that makes an atom bomb, or a score of them, look like a cap pistol. But, fortunately for this old world, this energy content is, in general, pretty stable. It is virtually inconceivable that either the mechanical or thermal shock of an atomic explosion could do more than trigger a rather small local storm. There may, however, be another factor of importance, as will be shown presently.

A cloud may be regarded as a colloidal suspension of water in air, and as such is not all violent until it starts releasing precipitation *rapidly*. Bergeron lists the following conditions as favoring colloidal stability:

(1) Uniform electrical charge of cloud elements;

(2) Uniform size of cloud elements;

(3) Uniform temperature of cloud elements;

(4) Uniform motion of cloud elements;

(5) Uniform phase of cloud elements (i.e. liquid and solid particles not coexistent);

and regards the last as most important.

Does the above suggest something to you? It did to several inquisitive experimenters who tried to trigger suitable cumulus clouds into precipitating by dropping electrically charged sand particles, and later dry-ice pellets, into them. Dr. Irving Krick of Denver employed a large staff of trained meteorologists and pilots who protect his clients from hail and cloudburst damage by "triggering" the destructive load out of potential cumulo-nimbus clouds before they reach the orchards and outdoor sporting events they were headed for.

In addition to "seeding" by aircraft from above, his agents also use smoke generators which give off clouds of fine silver iodide crystals which are drawn up into the clouds by updrafts, and accomplish similar results. Referring again to Bergeron's conditions for cloud stability—it may be that the effects of the first condition listed may be as powerful, or possibly more powerful, than the last, or possibly the fourth condition, or a combination of two or more.

Hypothesis: Radioactive products, if scattered throughout a Cumulus Cloud System above the Zero Degree C level, can initiate precipitation; or in marginal amounts, can greatly accelerate precipitation release, once it is initiated.

The above statement is something more than mere speculation, because there appears to be definite evidence of a practical nature to point the way. As John Campbell puts it, "Some things are theoretically possible, but not practical; some are theoretically impossible—until someone does 'em."

My attention was first directed to this line of inquiry by a well designed laboratory instrument that I was using to make humidity measurements in the inlet section of a supersonic windtunnel at the University of Maryland. The instrument gives results

of scientific accuracy, and yet the principle is simple.

Briefly, a desired sample of air is drawn into a test chamber and by means of a small manometer brought to some predetermined pressure ratio with another chamber called the fog chamber. When a valve between the two chambers is opened suddenly the air expands adiabatically, and if the initial pressure ratio was high enough, visible fog appears in the fog chamber. In order to ensure prompt and complete condensation, the makers saw fit to include in the fog chamber a small piece of radioactive gold foil. The total amount of radiation from such a device is quite small, but *it works.*

It has been found by experiment that if dust-free air saturated with water vapor is suddenly expanded to 1.25 times its original volume, the adiabatic cooling will be sufficient to cause condensation of water molecules upon any negative ions present in the air; moreover, if the expansion is to 1.33 times the original volume, water will condense on the positive ions as well. Formation of cloud elements with opposite polarity electrical charges would, of course, violate condition (1) of Bergeron, while formation of elements of different sizes would violate condition (2).

This raises an important question as to whether there might not be a "critical concentration" of positive or negative ionization which would give maximum triggering action to condensation? The actual quantitive effects of the above principles in triggering precipitation might be better determined by further research, than by a hasty answer, since the subject has not been adequately studied. The importance of ionized particles in the upper part of a cumulo-nimbus cloud as an agent for increasing the rate of energy release, once the process has been initiated, appears obvious from the discussion above.

As indicated, it is not yet certain that radioactivity alone could initiate real precipitation—but the proposition has certainly not been definitely disproved! It was stated as an hypothesis as a working tool, and to indicate the need for further research along these lines. But before a method is postulated by which the radioactivity *could*, possibly, trigger real precipitation, let's have a look at the mechanism which normally triggers such precipitation; and which is now fairly well understood.

To start with, a cumulus cloud can grow upward right through the 0° C. isotherm, and still remain substantially a pure-water cloud, in which case the droplets above the freezing level are undercooled and in a rather unstable state. An aircraft flown through this undercooled portion of the cloud would rapidly pick up a load of ice. As the cloud continues to grow upward a critical temperature level is finally attained for which the ice saturation is so low that its difference between the relative humidity—always near one hundred per cent in clouds—is sufficient to induce sublimation on the ice crystals. This temperature is believed to lie between −15 and − 20 Degrees C. Above this temperature level ice crystals are formed very rapidly due to violent sublimation. The undercooled water droplets vanish just as rapidly by evaporation, but some of them collide with ice crystals and freeze on them.

As soon as the ascending air current loses enough vertical velocity, that it can no longer support the rapidly falling ice crystals, they fall into the undercooled cloud below the critical level and continue to accumulate

rapidly, and may grow in size until they are large hailstones, which fall to earth. In weaker vertical currents, the hailstones do not grow so large, and may melt on the way down and reach the earth as rain. This process continues downward from the top of the cloud until the upper mixing zone reaches the Zero Isotherm, whereupon the main, or heavy, precipitation activity of the cumulus cloud is ended. Light rain may continue to fall from the lower levels.

The process described above suggests that, if the air above the zero isotherm were heavily ionized, the upward growth of a large cumulus cloud might be continued well beyond the level where it would otherwise stop. For instance, suppose that the cumulus cloud would, by itself, penetrate to a certain distance beyond the zero isotherm, but would stop short of the critical temperature level; and that moreover, the air above the zero isotherm were sufficiently ionized. Condensation of the water vapor in the upper portion of the cloud would be accelerated by the mechanism already described, which would add heat energy to this upper portion and cause it to rise still further, until it penetrated the critical temperature level—then the fat would be in the fire! Not only would the triggering mechanism be actuated, but the rate of energy release would also be accelerated, and the storm would be more violent than normal. The process just described is seen to be closely allied to the dry ice and silver iodide methods already mentioned.

Admittedly this sort of approach

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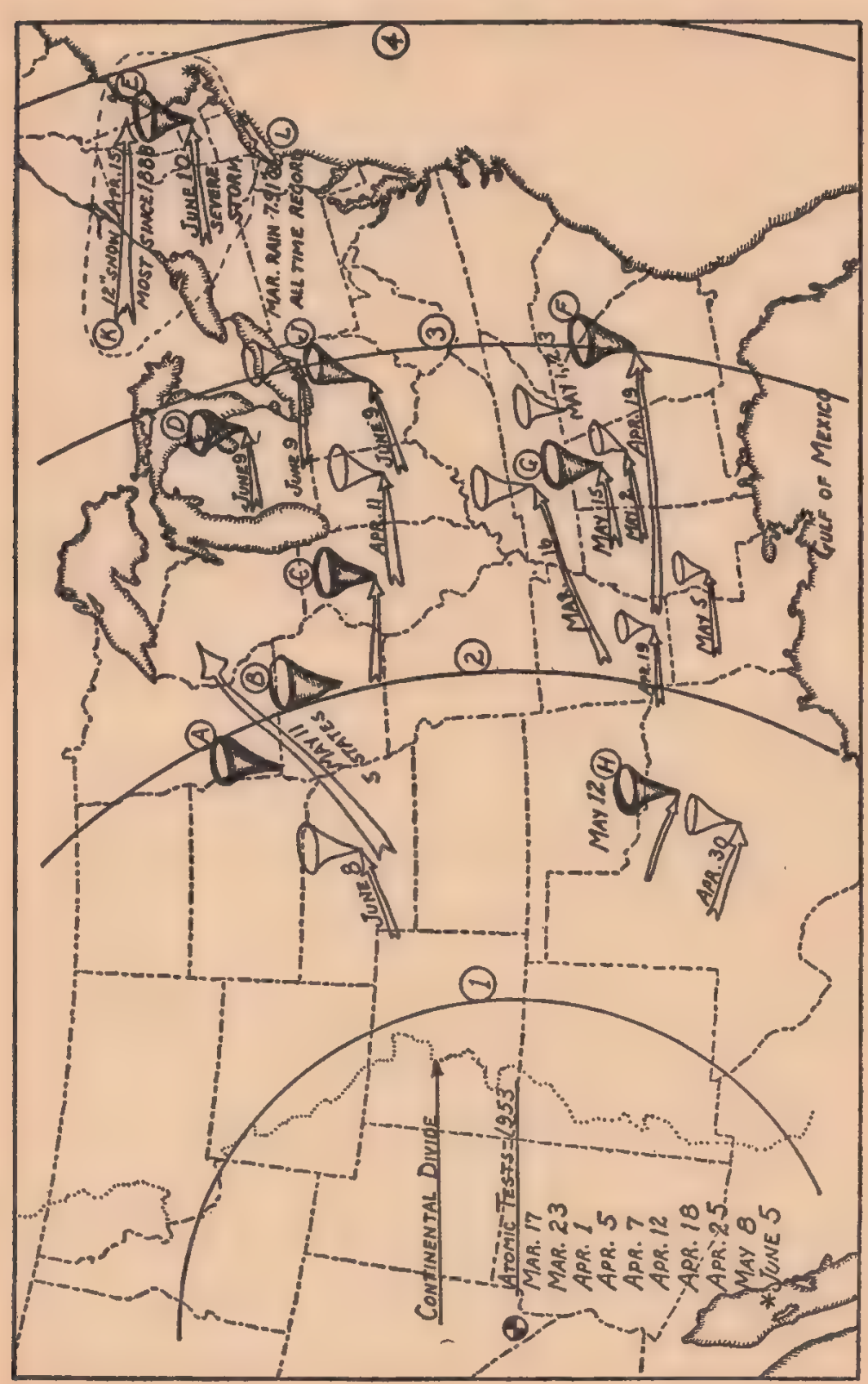
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12" SNOW APR. 15
MOST SINCE 1888
JUNE 10
SEVERE STORM
HEAV. RAIN 7.9" ALL TIME RECORD
JUNE 9
JUNE 9
JUNE 9
APR. 11
MAY 11
MAY 15
MAY 2
APR. 19
MAR. 19
MAY 5
APR. 19
GULF OF MEXICO
MAY 11
STATE S
JUNE 8
MAY 12
APR. 30
CONTINENTAL DIVIDE
ATOMIC TESTS-1953
MAR. 17
MAR. 23
APR. 1
APR. 5
APR. 7
APR. 12
APR. 18
APR. 25
MAY 8
JUNE 5

FIG. 4

does not constitute final proof, but when it is coupled with the fact that abnormal amounts of radioactivity were measured in some of the most freakish precipitation that occurred this spring, it begins to carry more conviction—at least to me. We may as well examine some of this weather data, gathered from news stories, right now.

The United States Weather Bureau reports 130 tornadoes between January and September, 1953, and lists 29 states as having precipitation above normal. It is most probable that the tornado figure is on the low side, since at this time we do not have an organized tornado tracking and recording service, and many of them occur in remote areas and are not reported. Simply to list all this data, much less analyze it, is a formidable task, and will not be attempted here. Instead, there is listed a partial rundown of news stories from the New York *Times* and the *Associated Press*, which, coupled with a plot of this data on a chart of the United States (Fig. 4), serves to give a rapid overall view of the subject weather situation. The cones represent tornadoes, and are placed approximately with the approximate dates of occurrence shown. The shaded cones also serve to indicate states, which according to the *Associated Press*, suffered most heavily from tornado damage this year.

The dates listed beside the site of the atomic tests, on the chart, are from the New York *Times Index*. That of March 17th is identified as a tactical weapon, that of April 1st only as a small "device," and the smallness of the explosion caused comment; the one made on April 5th was exploded at a five thousand foot altitude, and the test of June 5th was the largest of the series, roughly equivalent to forty thousand tons of TNT, and was exploded between thirty to forty thousand feet altitude. This last date has a star in front of it, as it is of particular interest. The information shown has not been completely verified, but suffices for a rapid initial survey.

A meteorologist's rule of thumb is that pressure systems move eastward across the country at a uniform rate of five hundred miles per day in summer, and seven hundred miles per day in winter. The average, which applies better to the period under discussion, is six hundred miles per day. The four numbered arcs on the chart, with the Atomic Test Site as a center, were included to aid in visualizing the eastward rate of progress, and are spaced six hundred miles apart.

The rule given above loses most of its validity in the Mountain Regions of the West, however. A fact, well-known to practical meteorologists and experienced pilots, is that a storm system will travel at a fairly uniform rate of some six hundred miles per day across the Pacific, but when it reaches the High Sierras it is not only intensified, but also *delayed* for a time period which may be as much as two or three days. The dotted line on the chart represents the Continental Divide, which marks not only the region of divergence of precipitation runoff, but in its central portion might be considered the backbone of the Rocky Mountains, some of whose peaks rise more than fourteen thousand feet above sea level.

In addition to the effect of high mountain ranges on the eastward movement of pressure systems, an air mass from the Pacific Ocean, for example, might be blocked for a while from eastward movement by a high pressure mass of cold air from Canada moving at a relatively high

ground velocity into the plains states of the Midwest.

Due to editorial space requirements, no further weather data is presented here; but if, at this point, an initial delay factor is simply assumed by virtue of the above information—in the Continental Divide area—the tornado events of June 8th, 9th, 10th, correlate remarkably with the large high-level explosion at Yucca Flats on June 5. Similarly other possible correlations may be seen by careful analysis of the chart and available weather data. This initial survey suggests that an actual step-by-step analysis of the large quantities of weather data required, plus all pertinent radioactivity reports, if available, might be well worth while.

TABLE I

* WEATHER AND TORNADO DATA

Date	*Code*	*Location*	*Killed*	*Hurt*	*Property Damage*
March 20	L	Radioactive rainfalls NYC			
March 31	L	March rainfall 7.91 inches (All time record!)			
April 11	Tor.	Albany, Indiana	2		
April 15	K	New England States; 12″ snow, record since 1888.			
April 19	F	Ala., Ark., Ga.; Tornadoes	9	200	$3 Million
April 30		Texas; Tornado	2		
April 30	L	NYC April rainfall 5.99″, 2.77″ above normal. Weather			
do		Bureau reports January to April precipitation sets sixty-year record.			
do		*News Story;* Two prospectors still emitting radiation eighty hours after dust covers their truck.			
May 1		Warner Robins, Ga.	13	300	$1 Million
May 2, 3		Ga., Ala., Tenn.; Tornadoes	41	100's	$20 Million 1000 homes
May 11	A, B	5 state area (Minn., Neb.)	9		
May 12	H	Waco & San Angelo, Texas	34		
May 15	G	Ala., Miss., Tenn.			
June 8		Arcadia, Neb.	10		
June 9	J	Cleveland, Ohio (First tornado in twenty-nine years)	8	300	
June 9	D	Flint, Mich. (eight tornadoes in Mich. and Ohio)	113		$12 Million
June 10	E	Worcester, Mass. (Worst in seventy-five years, twenty-five hundred homeless—Giant hailstones hit Steuben County area)	85	700	$58 Million
do		New Hampshire — Severe storm Exeter heavily damaged.			

* Source: New York, *Times Index.*

ORTHODOXY IN SCIENCE

By L. SPRAGUE DE CAMP

***The Noble** Ideal of Science is that it should be based on the fundamental question "What's right?" and NOT on "Who's right?" But . . . who's going to decide that the decision is on the ideal basis? Orthodoxy and research—which is science—are inherently incompatible.*

A FEW years ago a cousin of mine was called to jury duty on a suit brought by a woman to evict a man from her apartment-house. This tenant, she asserted, had violated his lease by staging wild drunken parties during which he pursued shrieking naked women about his apartment.

The defendant denied wrongdoing, but when pressed by the plaintiff's lawyer he muttered that, after all he was a normal human being.

Now it is a curious fact that if you ask a man how he is distinguished from other primates he will tell you that he has a better brain and guides his actions with it. Yet the same man, when he acts most like a monkey, excuses his behavior on the ground that he is being "human." Moreover, he is wont to condemn a fellowman who uses his brain to guide his actions more consistently than he himself does on the ground that the other fellow is not "human."

In this trial, though the defendant had virtually admitted his guilt, a juror exercised his right to be "human" by holding out for the defendant and forcing a mistrial. His reason was that the defendant belonged to a persecuted minority; therefore—though no such allegation had been made—the trial was a plot, actuated by group prejudice, against the defendant. The juror, who belonged to another persecuted minority, wasn't going to allow that!

As I have said before, there is every reason to think that scientists really are, on the average, more intelligent than most people; though many people, being "human" in this simian sense, are reluctant to admit the fact. Does that mean that scientists always use their superior brains to guide their actions?

Alas, no. It transpires that scientists, too, are "human." That is why there are disputes about "scientific orthodoxy" and "orthodox science." These are opprobrious terms used by people who advance or sympathize with some novel, minority, or heterodox view of a scientific question, to mean the majority or traditional view that the new theory is supposed to overturn. Adherents of the majority view, on the other hand, refer to their own outlook as "established facts" or "confirmed natural laws," and to the

heterodox view as "unfounded speculation" or even "crackpot pseudoscience."

How do you tell which is right?

Recently P. Schuyler Miller reviewed (ASF, Apr. '53, pp. 148–54) Martin Gardner's excellent book on pseudoscientific cults and doctrines, "In the Name of Science." But taking apart Velikovsky, the pyramidologists, and the hollow-earthians is like shooting fish in a bathtub. There are many harder cases where, as Hippocrates said, "the occasion is fleeting, experience is deceptive, and judgment is difficult." The proponent of the heterodoxy may be, or appear to be, a competent scientist. His hypothesis may plausibly hang together and appear to explain hitherto unexplained facts: for example, the recent cosmological theories of the English astronomer Fred Hoyle. After all, the "established facts" of today all started out as heterodoxies and radical speculations.

Does that mean that every theory advanced by a bright young man in a hurry should be accepted at once, discarding as many older beliefs as may be necessary?

Not at all. When we dig into the history of science, we find that for every new theory that became accepted, there were lots of others that did not. Often there were alternative and mutually exclusive explanations of a given set of facts, which could not all be right. Perhaps one set proved right and the other wrong, or perhaps both were wrong, or each was partly right. And there is *no* touchstone, no ideological litmus-paper, no simple way to tell in advance which will prevail. Picking winning scientific theories is not unlike picking winning horses. Some do it better than others, but how much of that is luck and how much is brains is known to nobody.

A favorite cliché of science-fictional plots is the brilliant but unorthodox young scientist who makes a wonderful discovery or advances a radical theory only to be scorned, denounced, and oppressed by his hidebound old fossils of elders. This is not surprising, as the history of science contains cases where this happened, though not so many as some have thought. Somehow nobody ever writes a story in which the old fossil turns out to be right, though that happens, too. In fact these events occur in all combinations.

Suppose there are known facts A, B, and C. These are usually explained by the accepted theory Alpha. Then somebody finds the fact D which shows that Alpha won't do.

We have, say, two old scientists, Dr. Fuddy and Dr. Duddy, and two young scientists, Dr. Whipper and Dr. Snapper. Drs. Whipper and Snapper, being full of juice, each comes up with a new theory to explain ABCD, but the two theories are mutually exclusive and nobody can tell which is right until somebody uncovers a new fact E to decide between them. Call them Beta and Gamma.

Dr. Fuddy rejects both theories outright, saying he doesn't believe the fact D exists and Alpha is still good enough for him. The more radical-minded Dr. Duddy, however, missed a promotion recently and would like to do Fuddy one in the eye, so he wholeheartedly embraces theory Beta.

Years later, fact E does come to light, and what does it show? Perhaps that Beta is right; perhaps that Gamma is right; perhaps that both are wrong. There is no way of telling which will win before that time.

Suppose Beta proves right, justifying Duddy and Whipper. Does Snapper give in? Maybe. But sometimes he has become so emotionally identified with Gamma that instead he be-

comes a fanatic on the subject and forms a pseudoscientific cult based on Gamma. And the victorious Whipper, does he in later years show the same open-mindedness towards new hypotheses that he would have liked everybody to extend to him when he was young? Well, sometimes; but often he grows up into a perfect Fuddy in his turn.

An example is one of the leading scientists of a century ago: the big, volatile, enthusiastic Swiss biologist and geologist Louis Agassiz. By careful study of the geology of Europe and particularly of Switzerland, young Agassiz concluded that in recent geological times large parts of that region had been covered by glaciers; in other words, that there had been an Ice Age.

This announcement provoked a storm of opposition. Agassiz's friend, Leopold von Buch, an older geologist and an adherent of Cuvier's theory of periodical catastrophes wiping out all life, laughed at Agassiz when he heard his first lecture on glaciation, and told him that outside his proper field of ichthyology he was no better than a quack. Agassiz's patron, Baron von Humboldt, wrote him that he was wasting his time chasing glacial phantasies and ought to stick to his fish.

On the other hand Lyell and Darwin, when they read the theory and checked it against what they knew, both accepted the glacial hypothesis. In fact Agassiz's glacial theory and his exhaustive classification of fishes, living and fossil, provided Darwin with some of the materials which, years later, he synthesized into his wonderful construct of evolution by natural selection.

By this time (1859–60) Agassiz had long since settled in the United States as a professor at Harvard. He was now in his fifties: a ponderous, balding man with bushy gray side-whiskers. The more he looked into the Darwinian theory the less he liked it. Far from embracing the revolutionary discovery for which he himself had furnished much of the basis, he remained to his death an unshakable anti-revolutionist. Though not an excessively religious man and himself sometimes attacked on religious grounds for his geological teachings, he nevertheless found Darwinism too hard to reconcile with his religious beliefs.

Agassiz's great colleague, James Dwight Dana, at first took a similar line, but after examining more evidence over the years and thinking about the matter he began to waver and planned to amend the next edition of his textbook of geology to admit of evolution. Hearing of this, Agassiz went to see Dana and begged him for old friendship's sake not to do so. Dana obligingly held up publication of his second edition until after Agassiz's death!

Nor is Agassiz unique. Refusal to accept a new idea that is later confirmed does not prevent a man's being a great scientist.

When we speak of great scientists martyred by religious authority we think of Galileo Galilei, one of the very few genuine martyrs of this kind for the suppression of science by the medieval Church has been much exaggerated. When we mention Galileo we think in turn of his enormous accomplishments: improvements in the telescope and microscope, discovery of Jupiter's moons, discovery of the laws of the pendulum and of falling bodies, and so on.

Well, Galileo adopted the heliocentric hypothesis of Copernicus and got into trouble with the Church because of the impetuous zeal with which he sought to spread the idea. (He might have gotten away with it if he had stayed away from theology, or had

been a smooth operator like René Descartes or Francis Bacon instead of the rash, peppery, quarrelsome man he was.)

The superseded Ptolemaic hypothesis accounted for the apparent backtracking of planets across the sky by supposing that they traveled in looping curves called epicycles. Copernicus got rid of the epicycles but supposed that the planets traveled in circles. This idea failed to fit observation exactly because, as Galileo's contemporary Kepler discovered, they really swing in ellipses. But, though Galileo engaged in a long and friendly correspondence with Kepler, he resolutely ignored Kepler's ellipses and insisted on trying to correct Copernicus' circles by a combination of circles and epicycles in the Ptolemaic manner.

Likewise Francis Bacon, though in other ways a man of immense brilliance, rejected the whole heliocentric idea with a sneer at "these cartmen who move the earth." And John Dalton, who established the substances are mostly made up of molecules which in turn consist of fixed numbers of atoms of different elements, went to his grave insisting that the right formula for water was HO despite the evidence adduced by his colleagues that it was H_2O.

On the other hand some scientists have been so open-minded as to be taken in by false beliefs, even by bizarre and transparent pseudoscientific quackeries.

A classic example is that of Charles Piazzi Smyth, the Scottish astronomer, who did valuable pioneer work in spectroscopy, but also fell for the fantastic idea of the London publisher, John Taylor, that the Great Pyramid at Gizeh was not, as had been thought, the tomb of King Khufu of the Fourth Dynasty, but had been built under divine guidance by Noah or some other Old-Testament patriarch and incorporated in its measurements the wisdom of the ages and a prophecy of the future of mankind.

Again, Sir Joseph John Thomson,* the discoverer of the electron, displayed a leaning towards belief in dowsing that, in the present state of geological science, goes a little beyond plain scientific impartiality into the boundless realm of credulity. And finally J. B. S. Haldane became a Marxist because being one cured his indigestion. (But Lysenkoism, the form of neo-Lamarckism developed in Russia by Michurin and Lysenko to make biology conform to political expediency, was too much even for him.)

As for a scientist's becoming a pseudoscientist, consider Franz Anton Mesmer. After some years of humdrum medical practice in Vienna he found he could cure people by waving magnets at them. Then he learned that a priest was performing similar cures by waving his hands without magnets. Like a proper scientist Mesmer discarded magnets, though he kept the unfortunate name of "magnetism" for his effects. After a bitter quarrel with the other physicians of Vienna over the reality of his effects he went to Paris.

Mesmer had made a real discovery, hypnosis, but had devised a completely wrong theory to account for it. "Orthodox science" rejected both his true discovery and his false theory. Mesmer conversely adhered to both with the tenacity of mania. Though in Vienna he had been known as a quiet, unassuming man, he now blossomed out with all the showmanship of a

* Try not to confuse him with Sir John Arthur Thomson the biologist, Sir William Thomson (Baron Kelvin) the physicist, or Benjamin Thompson (Count Rumford) the physicist, not to mention several other prominent scientific Thomsons and Thompsons.

quack, with "magnetic" séances, fancy costumes, and secret societies. And so he continued until in old age he retired to Switzerland to write a huge forgotten treatise showing that he had always been right and his benighted "orthodox" opponents wrong.

Evidently scientists are "human" too—all too much so for the good of their science.

Just what do we mean by "scientific orthodoxy"?

There is, inevitably, at any one time and in any given science, a concensus of opinion on most questions. Right now, for instance, geographers agree that the earth is round. Sometimes, as in the case of the shape of the earth, the concensus arrives at an opinion that it shows every sign of keeping forever. At other times the concensus changes: sometimes quickly and sometimes slowly, sometimes quietly and sometimes to the deafening tune of public quarrels and controversies. When there is a strong majority for an opinion among scientists we speak of this opinion as "orthodoxy," but today's orthodoxy may be overthrown and become an obsolete heterodoxy like flat-earthism. As Benjamin Franklin wrote his friend Kinnersley about the possibility of fitting their electrical discoveries into traditional electrical theory:

> But this you jokingly call "electrical orthodoxy." It is so with some at present, but not with all; and perhaps, it may not always be orthodoxy with any body. Opinions are continually varying, where we cannot have mathematical evidence of the nature of things; and they must vary. Nor is that variation without its use, since it occasions a more thorough discussion, whereby error is often dissipated, true knowledge is increased, and its principles become better understood and more firmly established.

Once such an orthodoxy exists, whether well or badly founded, people vary in their reaction to proposals that upset it. This variation seems to be more a matter of that intangible thing called temperament than of intelligence. Some who have a rebellious or iconoclastic temperament tend to favor new ideas, not because they are necessarily right but because they are new, while others prefer old ones solely because they are old.

Many men will accept or welcome minor discoveries but boggle at revolutionary ones, regardless of their merits. In actual practice, the great majority of scientific discoveries are minor. And even of the major ones most take the form of a more accurate description of the facts rather than a complete overturn of existing belief. For instance the change from the cosmogony of Ptolemy to that of Copernicus involved a major overturn—though if you insist, Ptolemy can still be considered right from the viewpoint of strict relativity. But you know what I mean. However, the change from Copernicus' circles to the ellipses of Kepler and Newton was a change in the direction of greater accuracy of description, not a complete overturn. And the later change to Einstein's description of the same phenomena was in the direction of greater accuracy yet. Although Einstein's equations look entirely different from Newton's, the actual change in the orbits themselves is very small.

As a science grows up, the complete revolutionary overturns, like those effected by Copernicus and Darwin and Pasteur, become rarer and rarer. While it is conceivable that such changes might yet upset the theories of these three scientists, by proving, say, that the heavenly bodies don't exist at all but are mere atmospheric

illusions, or that monkeys are descended from men instead of vice versa, the chance of such an overturn, as far as a reasonable man can judge, are negligible. So even if no scientific theory is ever *completely* "established," it often becomes established quite well enough for all ordinary human purposes.

Now, a man who has himself played a part in the establishment of the present orthodoxy—who made some of the discoveries or advanced one of the theories—is likely to cling more tightly to it than one who has a more disinterested viewpoint. While many scientists achieve a degree of detachment and objectivity rare among laymen, hardly any are so completely rational that they would actually welcome a discovery that overturns and makes obsolete the beliefs that they have spent their lives promoting.

Sometimes in fact a scientist has quite a time convincing himself of the validity of his own new discoveries where these clash with his previous beliefs. When Dana, having read Darwin's "Origin of Species," wrote Darwin that he was still not convinced of evolution, Darwin replied that he was not surprised, as "I remember well how many years I fought against my present self." And when J. J. Thomson announced his discovery of the electron in 1897,

> At first there were very few who believed in the existence of these bodies smaller than atoms. I was even told long afterwards by a distinguished physicist who had been present at my lecture at the Royal Institution that he thought I had been "pulling their legs." I was not surprised at this, as I had myself come to this conclusion of my experiments with great reluctance, and it was only after I was convinced that the experiment left no escape from it that I published my belief in the existence of bodies smaller than atoms.

Then does scientific orthodoxy serve a useful function?

Yes, because without a certain skepticism towards novelties there would be no way of distinguishing those on the right track from those on the wrong. The hollow earth would stand on the same basis with the solid earth. The phlogiston and caloric theories would still compete with Count Rumford's kinetic theory of heat. Textbooks would have to give space to "odic force," "auras," "mitogenetic rays," and the contentions of Lysenko and Velikovsky as serious possibilities. In view of the difficulty of a modern scientist in learning enough to qualify him for advanced work before he is old and worn out, such a possibility is appalling.

Thus orthodoxy acts as a kind of filter for new ideas. Ideally it would provide just enough resistance to them to make their proponents extend themselves to confirm them, and to show up weaknesses of those that were not sound, but not enough resistance to suppress any valuable new discovery.

In practice it seldom works so efficiently as this. It often forces sound ideas to struggle a long time for survival, while letting many quackeries flourish. Max Planck, writing of the reluctance of his colleagues to accept his quantum theory, said: "new scientific truth does not triumph by convincing its opponents and making them see the light but rather because its opponents eventually die." This is not wholly true, as witness the cases of Dana and others who accepted evolution, contrasted with Agassiz who never did. But there is truth in it.

The reason for this state of affairs is that "orthodoxy" is a general, relative term that covers a variety of attitudes among different people. Some are more skeptical towards novelties than others. A man may be more

skeptical at one time than another. While he is likely to become more devoted to orthodoxy as he grows older, this is not a universal rule either. I know a man whose father was a missionary in Africa. After years of teaching the Congolese the doctrines of his sect he became convinced that these doctrines were untrue. He returned to the United States, took courses in anthropology, and went back to the Congo as an anthropologist.

The general state of "orthodoxy" also varies from time to time. Its grip on the minds of men has greatly weakened during the last century. The reason is not that men are better or wiser than they were, but the same reason that science fiction has come to flourish so remarkably in that time: the fact that change has, as a result of the scientific research revolution, become such a constant and conspicuous element in human affairs that people grow up expecting it as a matter of course. A hundred years ago teachers and textbooks were much surer that the last word had been said on various branches of science than they are today, though there is every reason to think that we know much more now than we did then.

Some science-fiction stories have been based upon the invincible incredulity of people towards new facts: for instance, stories in which people refuse to believe in the reality of Martians who land on Earth. A hundred years ago such a reaction would have been plausible. But today, I think, if you told the average American that Martians had just landed in Kansas, he would look at you with a vaguely confused expression and reply:

"Huh? Oh, I thought we'd been in touch with Mars for years! Didn't a guy named Orson Welles go there back before the War?"

So, if scientific orthodoxy is a filter, it is a most imperfect one, irregularly shaped and with holes of different sizes. In fact there are even people, such as Forteans and occultists, who perversely deny the best-substantiated scientific advances while credulously accepting the wildest pseudoscientific speculations.

It would be nice if there were some way to improve the filter so that it worked better, letting through the right theories and straining out the wrong. But that seems unlikely so long as human beings go on being "human." If they had been either much more conservative or much fonder of novelties than they are, they would probably never have developed an effective body of science at all, in the first case because they would have rejected every discovery, in the second because they would have embraced all assertions, speculations, and fictions with the same indiscriminate enthusiasm.

There is also another kind of orthodoxy, not scientific, but sometimes imposed upon science from outside by a church or government for its own purposes. Examples are the suppression of Copernicanism by the Catholic Church; of Darwinian evolution by various American states under pressure from Protestant leaders; of Einsteinian relativity by Hitler's government; and of Mendelian genetics by Stalin's. In such cases orthodoxy does nothing to promote the truth—quite the reverse, since the suppressions have nothing to do with the scientific merits of the questions.

Despite the fears of many people, there is not much of this sort of thing in the United States. There have, however, been examples, aside from anti-evolutionary laws: for instance the

recent firing of Dr. Allen V. Astin, Director of the National Bureau of Standards, by Secretary of Commerce Sinclair Weeks, for the refusal of the Bureau to indorse a dubious commercial product known as a battery additive. To judge by the statements attributed to him, Secretary Weeks believes it the duty of scientists to tailor their scientific findings in accordance with the commercial interests of businessmen.

Another example was the firing last year of a college instructor in chemistry because of his advocacy of Lysenkoism. The reason given was that by embracing a pseudoscientific cult this man had shown himself a person of weak judgment. In view of the evidence against Lysenkoism, the man's judgment is certainly open to suspicion. On the other hand he was teaching chemistry, not genetics, so it is hard to see what harm his eccentricity was doing. If his superiors wished to fire him for Communist sympathies, they should have said so. And if everybody who entertained an irrational belief were fired there would be few left. A national Director of Science, who was a nontheist, might decide that belief in God were an indication of irrationality and dismiss all scientists who admitted such a belief. As Hamlet said: "use every man after his desert, and who should 'scape whipping?"

When heterodoxy tries to overthrow an orthodoxy, or when two heterodoxies contend for the right to succeed an orthodoxy, scientific quarrels and controversies arise. These are waged in a milder and more decorous fashion than a few hundred years ago, when Paracelsus addressed colleagues as "you wormy and lousy sophist" and great scientists like Galileo attacked one another with venomous malignance. Perhaps the change is part of the general softening and restraint of manners in Western culture since the dueling era, when quarrelsomeness was deemed a sign of aristocratic spirit.

Still, such conflicts still become bitter enough by tame modern standards. The sincerity, intelligence, and good intentions of the fighters seem to have little to do with the case, In the 1890s two of Germany's leading psychologists, Wundt and Stumpf, conducted a famous controversy over the perception of tonal intervals that ended with their publishing articles in which each sarcastically advised the other how to conduct himself in a scientific manner. Yet both were intelligent and, as far as one can tell, well-meaning and sincere. The same can be said for the American psychologists Baldwin and Titchener who a few years later engaged in a similar dispute over reaction times. As things turned out, in each case both antagonists were partly right. And the last years of the last century and the first years of this were enlivened by fabulous feuds between the great paleontologists Cope and Marsh, and the equally great Assyriologists Jastrow and Hilprecht.

The trouble seems to be that when a man has identified himself with a particular opinion or school of thought any attack on that opinion becomes an attack on the man's own ego. When this happens, his glands take over from his cerebrum, and the man becomes "human." The human ego is such a sensitive thing that its owner will go to any lengths to protect it, and its first line of defense is an unshakable conviction of rightness and righteousness.

This sense of ego is applied by the man not only to himself and the ideas he has become identified with, but also

to other people who think as he does. Thus we get in-group psychology. A man habitually thinks of himself and certain others as "we," and everybody else as a hostile "they." That is, of course, why mankind devotes so much energy to feuds, wars, persecutions, discriminations, and nationalism. If you are convinced that "they" are an enemy out to get you, it is only logical to get them first. And what could "they" possibly do to convince you otherwise? Anything friendly they said would be a lie and anything friendly they did would be a trick to disarm you.

In-group psychology is less important in science than in most areas of human activity, since most scientists are individualists without strong group feelings and since they are wont to look upon other men as interesting specimens rather than as implacable foes. But this factor does enter in, so there are quarrels and feuds of cliques and schools having little to do with the merits of the scientific questions. Sigmund Freud, though in many ways a very impartial and objective man, gathered a small group of followers from whom he exacted complete loyalty and conformity. Adler and Rank belonged to this group but developed heresies and were, therefore, cast into outer darkness.

To gather all the material on which to base a new scientific principle and to push this principle to the fore is a lot of work. It takes a strong impetus or animus. Therefore, the man who accomplishes this is likely to be a forceful person so sure of his own rightness that he overcomes all obstacles. He may be right or wrong, but he pursues his objective with equal élan in either case. Many great scientists like Galileo, Freud, and the paleontologist, O. C. Marsh, have been of this aggressive, combative, peppery type. So have an enormous number of quacks, pseudoscientists, and scientists who had the misfortune to get started in the wrong direction. The men who finally decide which direction is right are apt to be calm, judicial types who could not make any such important discoveries themselves, but who still write the textbooks and head the university departments. As the psychologist Boring says:

> The paradox in science would seem to be that the more you fight for the truth the less you see it. If you are always trying to see it, you have no time to fight, and without fighting you get science nowhere; you are just the cautious critic who is afraid to venture research.

As movements require something to fight in order to keep up their enthusiasm, the leaders are likely to pick gratuitous quarrels with "orthodoxy" or to invent imaginary foes.

Some great scientist have also been men of modest, retiring personalities: Newton, Darwin, and Einstein, for example. But even Newton, though a shy, timid, nervous-Nellie kind of man, let his friends push him into a long and bitter quarrel with Leibniz over the invention of calculus. Newton and Darwin were fortunate in having belligerent friends to do their fighting for them: Halley, who bullied Newton into completing his work on physics and astronomy, and Huxley and Haeckel, who rushed about proclaiming the Darwinian revelation. A mousy scientist without such help may have his discoveries buried for decades, as happened to Gregor Mendel's findings in genetics.

Then how should you, as a reader, go about judging between new and old theories, between the orthodox and the heterodox?

The only sure way—and even it is

none too sure—is to examine all the evidence yourself at first hand. That means you actually look at the specimens, even if you have to cross oceans to do so. Any experiments you repeat, under adequate controls and safeguards. Any calculations and measurements you run over yourself to be sure they are accurate. Any assertions that cast doubt on previous beliefs you analyze by checking the evidence and the reasoning on which doubt is cast, and any objections to the new theory you investigate and weigh with equal thoroughness and judicious impartiality.

This is all very well, but it is a counsel of perfection. Nobody could possibly carry out such a procedure for all the new scientific and pseudoscientific theories that are advanced. An ordinary man lacks the knowledge and facilities, and even a professional scientist would not have time left to carry out his regular job and earn his living. If an assertion falls athwart the particular work in which he is engaged, he may consider it worth his while to investigate. If not, he will more likely wait for some better-qualified colleague to undertake that task before judging.

Nor do scientists consider themselves obligated to disprove all pseudoscientific theories. Every prominent scientist gets a lot of crank letters and soon learns that, no matter how absurd the statements therein, it does no good to argue with the writers, who are obsessed by fixed ideas that nothing can change. Besides, the scientist has his own work to attend to, and life is short. So he gets in the habit of answering such missives noncommittally or not at all, and the cranks then complain that they cannot get a hearing from "orthodox scientists," who are afraid to come out and fight because they know they would be licked. After all, say the cranks, didn't they scoff at Columbus and the Wright brothers? Then the fact that they scoff at me proves that I, too, am right.

Even a popularizer like myself, who makes a specialty of debunking cults, is limited by practical considerations in the amount of time and effort I can give to it. If I undertook to write a book completely refuting Velikovsky, there would be no difficulty in finding the fallacies in Velikovsky's arguments and the errors in his assertions. But he dips into so many sciences, and cites so many sources, that to do the job properly would require a book at least as big as the original. And then who would buy it? For one of mankind's less endearing traits is that they will pay fortunes to be gulled, humbugged, and chicaned, but very little to be debunked and undeceived.

If, then, you cannot examine all the evidence and repeat all the experiments yourself, you can still save yourself from being misled to some extent by checking the theorist's assertions as far as you can. Thus when Velikovsky quotes Herodotos about a battle between Zeus and Typhon, and Hesiod on Phaethon's becoming a planet, and Isaiah on the destruction of Sennacherib's army by fire, you have only to turn to the books cited to learn that Herodotos and Hesiod and Isaiah said nothing of the sort.

Nevertheless as a practical matter you have to judge many such hypotheses on their superficies rather than on their intrinsic merit.

You can ask yourself if the discoverer really knows and understands the theories and laws that he proposes to overturn. If the new hypothesis contradicts existing theories in its field, does the man provide a plausible explanation for the failure of the discarded beliefs? Does he likewise explain contradictions between his theory and theories in other fields,

held to be well established, which it contradicts? Does he provide adequate substitutes for the hypotheses which he affects to supersede? If the discarded theories are supported by successful predictions or can be calculated with mathematical accuracy, can the same be said for the new theory?

And does the proponent of the new theory display the stigmata of the pseudoscientist: a disposition to quote eccentric, minority, or obsolete views, to denounce the stubborn blindness of "orthodox science," and to claim a special, exclusive revelation that will overturn, not one earlier belief, but a multitude of them in many fields? Does he show signs of delusions of grandeur or persecution?

Of course such criteria are not final. Occasionally a real scientist can be a paranoid type, too. The amateur—a Louis Pasteur, a Samuel Morse, or a William Morton—is sometimes right and the professionals wrong. And so far as "established beliefs" are concerned, it is conceivable that tomorrow somebody will really prove that the earth is flat, or that werewolves exist, or that diseases are caused, not by germs, but by astrological influences. But I don't think the chance is big enough to worry about.

Still, it seems to be a fact—an established, orthodox fact if you will—that there is *no* method of judging scientific theories that is *both* easy and sure, and no method at all that is completely certain. In other words, if you are going to make up your mind at all on controversial scientific matters, you have to take a chance of making a mistake.

But then, who are you that you should never make a mistake?

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THE END

FIRST TO SERVE

By ALGIS BUDRYS

If you build a machine that can serve you well and wisely . . . make sure, first, that you really want to be served both well and wisely! Maybe you just want to be served well . . .

Illustrated by van Dongen

THEI ar teetcing mi to reed n ryt n i wil bee abel too do this beter then.

pimi

MAS 712, 820TH TDRC,
COMASAMPS, APO 15,
September 28

Leonard Stein, Editor,
INFINITY,
862 Union St.,
New York 24, N. Y.

Dear Len,

Surprise, et cetera

It looks like there will be some new H. E. Wood stories for *Infy* after all. By the time you get this, 820TH TDRC will have a new Project Engineer, COMASAMPS, and I will be back to the old Royal and the Perry Street lair.

Shed no tear for Junior Heywood, though. COMASAMPS and I have come to this parting with mutual eyes dry and multiple heads erect. There was no sadness in our parting—no bitterness, no weeping, no remorse. COMASAMPS—in one of its apparently limitless human personifications—simply patted me on my side and told me to pick up my calipers and run along. I'll have to stay away from cybernetics for a while, of course, and I don't think I should write any robot stories in the interval, but, then, I never did like robot stories anyhow.

But all this is a long story—about ten thousand words, at least, which means a $300 net loss if I tell it now.

So go out and buy some fresh decks, I'll be in town next week, my love to the Associate and the kids, and first ace deals.

Vic Heywood

My name is really Prototype Mechanical Man I, but everybody calls me Pimmy, or sometimes Pim. I was assembled at the eight-twentieth teedeearcee on august 10, 1974. I don't know what man or teedeearcee or august 10, 1974, means, but Heywood says I will, tomorrow. What's tomorrow?

Pimmy

August 12, 1974

I'm still having trouble defining "man." Apparently, even the men can't do a very satisfactory job of that. The 820TDRC, of course, is the Eight Hundred and Twentieth Technical Development and Research Center of the Combined Armed Services Artificial and Mechanical Personnel

Section. August 10, 1974, is the day before yesterday.

All this is very obvious, but it's good to record it.

I heard a very strange conversation between Heywood and Russell yesterday.

Russell is a small man, about thirty-eight, who's Heywood's top assistant. He wears glasses, and his chin is farther back than his mouth. It gives his head a symmetrical look. His voice is high, and he moves his hands rapidly. I think his reflexes are overtriggered.

Heywood is pretty big. He's almost as tall as I am. He moves smoothly—he's like me. You get the idea that all of his weight never touches the ground. Once in a while, though, he leaves a cigarette burning in an ashtray, and you can see where the end's been chewed to shreds.

Why is everybody at COMA-SAMPS so nervous?

Heywood was looking at the first entry in what I can now call my diary. He showed it to Russell.

"Guess you did a good job on the self-awareness tapes, Russ," Heywood said.

Russell frowned. "Too good, I think. He shouldn't have such a tremendous drive toward self-expression. We'll have to iron that out as soon as possible. Want me to set up a new tape?"

Heywood shook his head. "Don't see why. Matter of fact, with the intelligence we've given him, I think it's probably a normal concomitant." He looked up at me and winked.

Russell took his glasses off with a snatch of his hand and scrubbed them on his shirtsleeve. "I don't know. We'll have to watch him. We've got to remember he's a prototype—no different from an experimental automobile design, or a new dishwasher

model. We expected bugs to appear. I think we've found one, and I think it ought to be eliminated. I don't like this personification he's acquired in our minds, either. This business of calling him by a nickname is all wrong. We've got to remember he's *not* an individual. We've got every right to tinker with him." He slapped his glasses back on and ran his hands over the hair the earpieces had disturbed. "He's just another machine. We can't lose sight of that."

Heywood raised his hands. "Easy, boy. Aren't you going too far off the deep end? All he's done is bat out a few words on a typewriter. Relax, Russ." He walked over to me and slapped my hip. "How about it, Pimmy? D'you feel like scrubbing the floor?"

"No opinion. Is that an order?" I asked.

Heywood turned to Russell. "Behold the rampant individual," he said. "No, Pimmy, no order. Cancel."

Russell shrugged, but he folded the page from my diary carefully, and put it in his breast pocket. I didn't mind. I never forget anything.

August 15, 1974

They did something to me on the Thirteenth. I can't remember what. I've gone over my memory, but there's nothing. I can't remember.

Russell and Ligget were talking yesterday, though, when they inserted the autonomic cutoff, and ran me through on orders. I didn't mind that. I still don't. I can't.

Ligget is one of the small army of push-arounds that nobody knows for sure isn't CIC, but who solders wires while Heywood and Russell make up their minds about him.

I had just done four about-faces, shined their shoes, and struck a peculiar pose. I think there's something seriously wrong with Ligget.

Ligget said, "He responds well, doesn't he?"

"Mm-m—yes," Russell said abstractedly. He ran his glance down a column of figures on an Estimated Performance Spec chart. "Try walking on your hands, PMM One," he said.

I activated my gyroscope and reset my pedal locomotion circuits. I walked around the room on my hands.

Ligget frowned forcefully. "That looks good. How's it check with the spec's?"

"Better than," Russell said. "I'm surprised. We had a lot of trouble with him the last two days. Reacted like a zombie."

"Oh yes? I wasn't in on that. What happened? I mean—what sort of control were you using?"

"Oh—" I could see that Russell wasn't too sure whether he should tell Ligget or not. I already had the feeling that the atmosphere of this project was loaded with dozens of crosscurrents and conflicting ambitions. I was going to learn a lot about COMA-SAMPS.

"Yes?" Ligget said.

"We had his individuality circuits cut out. Effectively, he was just a set of conditioned reflexes."

"You say he reacted like a zombie?"

"Definite automatism. Very slow reactions, and, of course, no initiative."

"You mean he'd be very slow in his response to orders under those conditions, right?" Ligget looked crafty behind Russell's back.

Russell whirled around. "He'd make a lousy soldier, if that's what CIC wants to know!"

Ligget smoothed out his face, and twitched his shoulders back. "I'm not

a CIC snooper, if that's what you mean."

"You don't mind if I call you a liar, do you?" Russell said, his hands shaking.

"Not particularly," Ligget said, but he was angry behind his smooth face. It helps, having immobile features like mine. You get to understand the psychology of a man who tries for the same effect.

August 16, 1974

It bothers me, not having a diary entry for the fourteenth, either. Somebody's been working on me again.

I told Heywood about it. He shrugged. "Might as well get used to it, Pimmy. There'll be a lot of that going on. I don't imagine it's pleasant—I wouldn't like intermittent amnesia myself—but there's very little you can do about it. Put it down as one of the occupational hazards of being a prototype."

"But I don't *like* it," I said.

Heywood pulled the left side of his mouth into a straight line and sighed. "Like I said, Pimmy—I wouldn't either. On the other hand, you can't blame us if the new machine we're testing happens to know it's being tested, and resents it. We built the machine. Theoretically, it's our privilege to do anything we please with it, if that'll help us find out how the machine performs, and how to build better ones."

"But I'm *not* a machine!" I said.

Heywood put his lower lip between his teeth and looked up at me from under a raised eyebrow. "Sorry, Pim. I'm kind of afraid you are."

But I'm not! *I'M NOT!*

August 17, 1974

Russell and Heywood were working late with me last night. They did a little talking back and forth. Russell was very nervous—and finally Heywood got a little impatient with him.

"All right," Heywood said, laying his charts down. "We're not getting anywhere, this way. You want to sit down and really talk about what's bothering you?"

Russell looked a little taken aback. He shook his head jerkily.

"No . . . no, I haven't got anything specific on my mind. Just talking. You know how it is." He tried to pretend he was very engrossed in one of the charts.

Heywood didn't let him off the hook, though. His eyes were cutting into Russell's face, peeling off layer after layer of misleading mannerism and baring the naked fear in the man.

"No, I don't know how it is." He put his hand on Russell's shoulder and turned him around to where the other man was facing him completely. "Now, look—if there's something chewing on you, let's have it. I'm not going to have this project gummed up by your secret troubles. Things are tough enough with everybody trying to pressure us into doing things their way, and none of them exactly sure of what that way *is*."

That last sentence must have touched something off in Russell, because he let his charts drop beside Heywood's and clawed at the pack of cigarettes in his breast pocket.

"That's exactly what the basic problem is," he said, his eyes a little too wide. He pushed one hand back and forth over the side of his face and walked back and forth aimlessly. Then a flood of words came out.

"We're working in the dark, Vic. In the dark, and somebody's in with us that's swinging clubs at our heads while we stumble around. We don't know who it is, we don't know if it's one or more than that, and we never know when the next swing is coming.

"Look—we're cybernetics engineers. Our job was to design a brain that would operate a self-propulsive unit designed to house it. That was the engineering problem, and we've got a tendency to continue looking at it in that light.

"But that's not the whole picture. We've got to keep in mind that the only reason we were ever given the opportunity and the facilities was because somebody thought it might be a nice idea to turn out soldiers on a production line, just like they do the rest of the paraphernalia of war. And the way COMASAMPS looks at it is not in terms of a brain housed in an independently movable shell, but in terms of a robot which now has to be fitted to the general idea of what a soldier should be.

"Only nobody knows what the ideal soldier is like.

"Some say he ought to respond to orders with perfect accuracy and superhuman reflexes. Others say he ought to be able to think his way out of trouble, or improvise in a situation where his orders no longer apply just like a human soldier. The ones who want the perfect automaton don't want him to be smart enough to realize he *is* an automaton—probably because they're afraid of the idea; and the ones who want him to be capable of human discretion don't want him to be human enough to be rebellious in a hopeless situation.

"And that's just the beginning. COMASAMPS may be a combined project, but if you think the Navy isn't checking up on the Army, and vice versa, with both of them looking over the Air Force's shoulder — Oh, you know that squirrel cage as well as I do!"

Russell gestured hopelessly. Heywood, who had been taking calm puffs on his cigarette, shrugged. "So? All we have to do is tinker around until we can design a sample model to fit each definition. Then they can run as many comparative field tests as they want to. It's their problem. Why let it get you?"

Russell flung his cigarette to the floor and stepped on it with all his weight. "Because we can't do it and you ought to know it as well as I do!" He pointed over at me. "There's your prototype model. He's got all the features that everybody wants—and cut-offs intended to take out the features that interfere with any one definition. We can cut off his individuality, and leave him the automaton some people want. We can leave him his individuality, cut off his volition, and give him general orders which he is then free to carry out by whatever means he thinks best. Or, we can treat him like a human being—educate him by means of tapes, train him, and turn him loose on a job, the way we'd do with a human being."

The uneven tone built up in his voice as he finished what he was saying.

"But, if we reduce him to a machine that responds to orders as though they were pushbuttons, he's slow. He's pitifully slow, Vic, and he'd be immobilized within thirty seconds of combat. There's nothing we can do about that, either. Until somebody learns how to push electricity through a circuit faster than the laws of physics say it should go, what we'll have will be a ponderous, mindless thing that's no better than the remote-control exhibition jobs built forty years ago.

"All right, so that's no good. We leave him individuality, but we restrict it until it cuts his personality down to that of a slave. That's better. Under those conditions, he would, theoretically, be a better soldier than

the average human. An officer could tell him to take a patrol out into a certain sector, and he'd do the best possible job, picking the best way to handle each step of the job as he came to it. But what does he do if he comes back, and the officer who gave him the orders is no longer there? Or, worse yet, if there's been a retreat, and there's nobody there? Or an armistice? What about that armistice? Can you picture this slave robot, going into stasis because he's got no orders to cover a brand-new situation?

"He might just as well not have gone on that patrol at all—because he can't pass on whatever he's learned, and because his job is now over, as far as he's concerned. The enemy could overrun his position, and he wouldn't do anything about it. He'd operate from order to order. And if an armistice were signed, he'd sit right where he was until a technician could come out, remove the soldier-orientation tapes, and replace them with whatever was finally decided on.

"Oh, you could get around the limitation, all right—by issuing a complex set of orders, such as: 'Go out on patrol and report back. If I'm not here, report to so-and-so. If there's nobody here, do this. If that doesn't work, try that. If such-and-such happens, proceed as follows. But don't confuse such-and-such with that or this.' Can you imagine fighting a war on that basis? And what about that reorientation problem? How long would all those robots sit there before they could all be serviced—and how many man-hours and how much material would it take to do the job? Frankly, I couldn't think of a more cumbersome way to run a war if I tried.

"Or, we can build all our robots like streamlined Pimmy's—like Pimmy when all his circuits are operating, without our test cutoffs. Only, then, we'd have artificial human beings. Human beings who don't wear out, that a hand-arm won't stop, and who don't need food or water as long as their power piles have a pebble-sized hunk of plutonium to chew on."

Russell laughed bitterly. "And Navy may be making sure Army doesn't get the jump on them, with Air Force doing its bit, but there's one thing all three of them are as agreed upon as they are about nothing else—they'll test automaton zombies, and they'll test slaves, but one thing nobody wants us turning out is supermen. They've got undercover men under every lab bench, all keeping one eye on each other and one on us—and the whole thing comes down on our heads like a ton of cement if there's even the first whisper of an idea that we're going to build more Pimmy's. The same thing happens if we don't give them the perfect soldier. *And the only perfect soldier is a Pimmy.* Pimmy could replace any man in any armed service—from a KP to a whole general staff, depending on what tapes he had. But he'd have to be a true individual to do it. And he'd be smarter than they are. They couldn't trust him. Not because he wouldn't work for the same objectives as they'd want, but because he'd probably do it in some way they couldn't understand.

"So they don't want any more Pimmy's. This one test model is all they'll allow, because he can be turned into any kind of robot they want, but they won't take the whole Pimmy, with all his potentialities. They just want part of him."

The bitter laugh was louder. "We've got their perfect soldier, but they don't want him. They want something less—but that something less will never be the perfect soldier. So we work and work, weeks on end,

testing, revising, redesigning. Why? We're marking time. We've got what they want, but they don't want it—but if we don't give it to them soon, they'll wipe out the project. And if we give them what they want, it won't really be what they want. Can't you see that? What's the matter with you, Heywood? Can't you see the blind alley we're in—only it's not a blind alley, because it has eyes, eyes under every bench, watching each other and watching us, always watching, never stopping, going on and never stopping, watching, eyes?"

Heywood had already picked up the telephone. As Russell collapsed completely, he began to speak into it, calling the Project hospital. Even as he talked, his eyes were coldly brooding, and his mouth was set in an expression I'd never seen before. His other hand was on Russell's twitching shoulder, moving gently as the other man sobbed.

August 25, 1974

Ligget is Heywood's new assistant. It's been a week since Russell's been gone.

Russell wasn't replaced for three days, and Heywood worked alone with me. He's engineer of the whole project, and I'm almost certain there must have been other things he could have worked on while he was waiting for a new assistant, but he spent all of his time in this lab with me.

His face didn't show what he thought about Russell. He's not like Ligget, though. Heywood's thoughts are private. Ligget's are hidden. But, every once in a while, while Heywood was working, he'd start to turn around and reach out, or just say "Jack—," as if he wanted something, and then he'd catch himself, and his eyes would grow more thoughtful.

I only understood part of what Russell had said that night he was taken away, so I asked Heywood about it yesterday.

"What's the trouble, Pim?" he asked.

"Don't know, for sure. Too much I don't understand about this whole thing. If I knew what some of the words meant I might not even have a problem."

"Shoot."

"Well, it's mostly what Russell was saying, that last night."

Heywood peeled a strip of skin from his upper lip by catching it between his teeth. "Yeah."

"What's a war, or what's war? Soldiers have something to do with it, but what's a soldier? I'm a robot—but why do they want to make more of me? Can I be a soldier and a robot at the same time? Russell kept talking about 'they,' and the Army, the Air Force, and the Navy. What're they? And are the CIC men the ones who are watching you and each other at the same time?"

Heywood scowled, and grinned ruefully at the same time. "That's quite a catalogue," he said. "And there's even more than that, isn't there, Pimmy?" He put his hand on my side and sort of patted me, the way I'd seen him do with a generator a few times. "O. K., I'll give you a tape on war and soldiering. That's the next step in the program anyway, and it'll take care of most of those questions."

"Thanks," I said. "But what about the rest of it?"

He leaned against a bench and looked down at the floor. "Well, 'they' are the people who instituted this program—the Secretary of Defense, and the people under him. They all agreed that robot personnel were just what the armed services needed,

and they were right. The only trouble is, they couldn't agree among themselves as to what characteristics were desirable in the perfect soldier—or sailor, or airman. They decided that the best thing to do was to come up with a series of different models, and to run tests until they came up with the best one.

"Building you was my own idea. Instead of trying to build prototypes to fit each separate group of specifications, we built one all-purpose model who was, effectively speaking, identical with a human being in almost all respects, with one major difference. By means of cut-offs in every circuit, we can restrict as much of your abilities as we want to, thus being able to modify your general characteristics to fit any one of the various specification groups. We saved a lot of time by doing that, and avoided a terrific nest of difficulties.

"Trouble is, we're using up all the trouble and time we saved. Now that they've got you, they don't want you. Nobody's willing to admit that the only efficient robot soldier is one with all the discretionary powers and individuality of a human being. They can't admit it, because people are afraid of anything that looks like it might be better than they are. And they won't trust what they're afraid of. So, Russell and I had to piddle around with a stupid series of tests in a hopeless attempt to come up with something practical that was nevertheless within the limitations of the various sets of specifications—which is ridiculous, because there's nothing wrong with you, but there's plenty wrong with the specs. They were designed by people who don't know the first thing about robots or robot thought processes—or the sheer mechanics of thinking, for that matter."

He shrugged. "But, they're the people with the authority and the money that's paying for this project—so Jack and I kept puttering, because those were the orders. Knowing that we had the perfect answer all the time, and that nobody would accept it, was what finally got Jack."

"What about you?" I asked.

He shrugged again. "I'm just waiting," he said. "Eventually they'll either accept you or not. They'll either commend me or fire me, and they might or might not decide it's all my fault if they're not happy. But there's nothing I can do about it, is there? So, I'm waiting.

"Meanwhile, there's the CIC. Actually, that's just a handy label. It happens to be the initials of one of the undercover agencies out of the whole group that infests this place. Every armed service has its own, and I imagine the government has its boys kicking around, too. We just picked one label to cover them all—it's simpler."

"Russell said they were always watching. But why are they watching each other, too? Why should one armed service be afraid that another's going to get an advantage over it?"

Heywood's mouth moved into a half-amused grin. "That's what is known as human psychology, Pimmy. It'll help you to understand it, but if you can't, why, just be glad you haven't got it."

"Ligget's CIC, you know," I said. "Russell accused him of it. He denied it, but if he isn't actually in *the* CIC, then he's in something like it."

Heywood nodded sourly. "I know. I wouldn't mind if he had brains enough, in addition, to know one end of a circuit from the other."

He slapped my side again. "Pimmy, boy," he said. "We're going to have a lot of fun around here in the next few weeks. Yes, sir, a lot of fun."

August 26, 1974

Ligget was fooling around with me again. He's all right when Heywood's in the lab with me, but when he's alone, he keeps running me through unauthorized tests. What he's doing, actually, is to repeat all the tests Heywood and Russell ran, just to make sure. As long as he doesn't cut out my individuality, I can remember it all, and I guess there was nothing different about the results on any of the tests, because I can tell from his face that he's not finding what he wants.

Well, I hope he tells his bosses that Heywood and Russell were right. Maybe they'll stop this fooling.

Ligget's pretty dumb. After every test, he looks me in the eye and tells me to forget the whole thing. What does he think I am—Trilby?

And I don't understand some of the test performances at all. There *is* something wrong with Ligget.

September 2, 1974

I hadn't realized, until now, that Heywood and Russell hadn't told anyone what they thought about this whole project, but, reviewing that tape on war and soldiering, and the way the military mind operates, I can see where nobody would have accepted their explanations.

Ligget caught on to the whole thing today. Heywood came in with a new series of test charts, Ligget took one look at them, and threw them on the table. He sneered at Heywood and said, "Who do you think you're kidding?"

Heywood looked annoyed and said, "All right, what's eating you?"

Ligget's face got this hidden crafty look on it. "How long did you think you could keep this up, Heywood? This test is no different from the ones you were running three weeks ago. There hasn't been any progress since then, and there's been no attempt to make any. What's your explanation?"

"Uh-huh." Heywood didn't look particularly worried. "I was wondering if you were *ever* going to stumble across it."

Ligget looked mad. "That attitude won't do you any good. Now, come on, quit stalling. Why were you and Russell sabotaging the project?"

"Oh, stop being such a pompous lamebrain, will you?" Heywood said disgustedly. "Russell and I weren't doing any sabotaging. We've been following our orders to the last letter. We built the prototype, and we've been testing the various modifications ever since. Anything wrong with that?"

"You've made absolutely no attempt to improve the various modifications. There hasn't been an ounce of progress in this project for the last twenty days.

"Now, look, Heywood"— Ligget's voice became wheedling— "I can understand that you might have what you'd consider a good reason for all this. What is it—political, or something? Maybe it's your conscience. Don't you *want* to work on something that's eventually going to be applied to war? I wish you'd tell me about it. If I could understand your reasons, it would be that much easier for you. Maybe it's too tough a problem. Is that it, Heywood?"

Heywood's face got red. "No, it's not. If you think—" He stopped, dug his fingers at the top of the table, and got control of himself again.

"No," he said in a quieter, but just as deadly, voice. "I'm as anxious to produce an artificial soldier as anybody else. And I'm not too stupid for the job, either. If *you* had any brains, you'd see that I already have."

That hit Ligget between the eyes. "You have? Where is it, and *why*

haven't you reported your success? What is this thing?" He pointed at me. "Some kind of a decoy?"

Heywood grimaced. "No, you double-dyed jackass, that's your soldier."

"What?"

"Sure. Strip those fifteen pounds of cutoffs out of him, redesign his case for whatever kind of ground he's supposed to operate on, feed him the proper tapes, and that's it. The perfect soldier—as smart as any human ever produced, and a hundred times the training and toughness, overnight. Run them out by the thousands. Print your circuits, bed your transistors in silicone rubber, and pour the whole brew into his case. Production difficulties? Watchmaking's harder."

"*No!*" Ligget's eyes gleamed. "And I worked on this with you! *Why haven't you reported this!*" he repeated.

Heywood looked at him pityingly. "Haven't you got it through your head? Pimmy's the perfect soldier—all of him, with all his abilities. That includes individuality, curiosity, judgment—and intelligence. Cut one part of that, and he's no good. You've got to take the whole cake, or none at all. One way you starve—and the other way you choke."

Ligget had gone white. "You mean, we've got to take the superman—or we don't have anything.'

"Yes, you fumbling jerk!"

Ligget looked thoughtful. He seemed to forget Heywood and me as he stared down at his shoetops. "They won't go for it," he muttered. "Suppose they decide they're better fit to run the world than we are?"

"That's the trouble," Heywood said. "They are. They've got everything a human being has, plus incredible toughness and the ability to learn instantaneously. You know what Pimmy did? The day he was assembled, he learned to read and write, after a fashion. How? By listening to me read a paragraph out of a report, recording the sounds, and looking at the report afterwards. He matched the sounds to the letters, recalled what sort of action on Russell's and my part the paragraph had elicited, and sat down behind a typewriter. That's all."

"They'd junk the whole project before they let something like that run around loose!" The crafty look was hovering at the edges of Ligget's mask again. "All right, so you've got an answer, but it's not an acceptable one. But why haven't you pushed any of the other lines of investigation?"

"Because there aren't any," Heywood said disgustedly. "Any other modification, when worked out to its inherent limits, is worse than useless. You've run enough tests to find out."

"All right!" Ligget's voice was high. "Why didn't you report failure, then, instead of keeping on with this shilly-shallying?"

"*Because I haven't failed, you moron!*" Heywood exploded. "I've got the answer. I've got Pimmy. There's nothing wrong with him—the defect's in the way people are thinking. And I've been going crazy, trying to think of a way to change the people. To hell with modifying the robot! He's as perfect as you'll get within the next five years. It's the people who'll have to change!"

"Uh-huh." Ligget's voice was careful. "I see. You've gone as far as you can within the limits of your orders—and you were trying to find a way to exceed them, in order to force the armed services to accept robots like Pimmy." He pulled out his wallet, and flipped it open. There was a piece of metal fastened to one flap.

"Recognize this, Heywood?"

Heywood nodded.

"All right, then, let's go and talk to a few people."

Heywood's eyes were cold and brooding again. He shrugged.

The lab door opened, and there was another one of the lab technicians there. "Go easy, Ligget," he said. He walked across the lab in rapid strides. His wallet had a different badge in it. "Listening from next door," he explained. "All right, Heywood," he said, "*I'm* taking you in." He shouldered Ligget out of the way. "Why don't you guys learn to stay in your own jurisdiction," he told him.

Ligget's face turned red, and his fists clenched, but the other man must have had more weight behind him, because he didn't say anything.

Heywood looked over at me, and raised a hand. "So long, Pimmy," he said. He and the other man walked out of the lab, with Ligget trailing along behind them. As they got the door open, I saw some other men standing out in the hall. The man who had come into the lab cursed. "*You* guys!" he said savagely. "This is *my* prisoner, see, and if you think—"

The door closed, and I couldn't hear the rest of what they said, but there was a lot of arguing before I heard the sound of all their footsteps going down the hall in a body.

Well, that's about all, I guess. Except for this other thing. It's about Ligget, and I hear he's not around any more. But you might be interested.

September 4, 1974

I haven't seen Heywood, and I've been alone in the lab all day. But Ligget came in last night. I don' think I'll see Heywood again.

Ligget came in late at night. He looked as though he hadn't slept, and he was very nervous. But he was drunk, too—I don't know where he got the liquor.

He came across the lab floor, his footsteps very loud on the cement, and he put his hands on his hips and looked up at me.

"Well, superman," he said in a tight, edgy voice, "you've lost your buddy for good, the dirty traitor. And now you're next. You know what they're going to do to you?" He laughed. "You'll have lots of time to think it over."

He paced back and forth in front of me. Then he spun around suddenly and pointed his finger at me. "Thought you could beat the race of men, huh? Figured you were smarter than we were, didn't you? But we've got you now! You're going to learn that you can't try to fool around with the human animal, because he'll pull you down. He'll claw and kick you until you collapse. That's the way men are, robot. Not steel and circuits—flesh and blood and muscles. Flesh that fought its way out of the sea and out of the jungle, muscle that crushed everything that ever stood in his way, and blood that's spilled for a million years to keep the human race on top. *That's* the kind of an organism *we* are, robot."

He paced some more and spun again. "You never had a chance."

Well, I guess that *is* all. The rest of it, you know about. You can pull the transcriber plug out of here now, I guess. Would somebody say good-by to Heywood for me—and Russell, too, if that's possible?

COVERING MEMORANDUM,
Blalock, Project Engineer,
to
Hall, Director,
820TH TDRC, COMASAMPS

September 21, 1974

Enclosed are the transcriptions of the robot's readings from his memory-

bank "diary," as recorded this morning. The robot is now en route to the Patuxent River, the casting of the concrete block having been completed with the filling of the opening through which the transcription line was run.

As Victor Heywood's successor to the post of Project Engineer, I'd like to point out that the robot was incapable of deceit, and that this transcription, if read at Heywood's trial, will prove that his intentions were definitely not treasonous, and certainly motivated on an honest belief that he was acting in the best interests of the original directive for the project's initiation.

In regard to your Memorandum 8-4792-H of yesterday, a damage report is in process of preparation and will be forwarded to you immediately on its completion.

I fully understand that Heywood's line of research is to be considered closed. Investigations into what Heywood termed the "zombie" and "slave" type of robot organization have already begun in an improvised laboratory, and I expect preliminary results within the next ten days.

Preliminary results on the general investigation of other possible types of robot orientation and organization are in, copies attached. I'd like to point out that they are extremely discouraging.

(Signed,)
H. E. Blalock, Project Engineer,
820TH TDRC, COMASAMPS

September 25, 1974

PERSONAL LETTER
FROM HALL, DIRECTOR,
820TH TDRC, COMASAMPS,
to
SECRETARY OF DEFENSE

Dear Vinnie,

Well, things are finally starting to settle down out here. You were right, all this place needed was a housecleaning from top to bottom.

I think we're going to let this Heywood fellow go. We can't prove anything on him—frankly, I don't think there was anything to prove. Russell, of course, is a closed issue. His chance

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of ever getting out of the hospital is rated as ten per cent.

You know, considering the mess that robot made of the lab, I'd almost be inclined to think that Heywood was right. Can you imagine what a fighter that fellow would have been, if his loyalty had been channeled to some abstract like Freedom, instead of to Heywood? But we can't take the chance. Look at the way the robot's gone amnesic about killing Ligget while he was wrecking the lab. It was something that happened accidentally. It wasn't supposed to happen, so the robot forgot it. Might present difficulties in a war.

So, we've got this Blalock fellow down from M.I.T. He spends too much time talking about Weiner, but he's all right, otherwise.

I'll be down in a couple of days. Appropriations committee meeting. You know how it is. Everybody knows we need the money, but they want to argue about it, first.

Well, that's human nature, I guess.

See you,

Ralph

SUPPLEMENT TO CHARTS: Menace to Navigation.

Patuxent River, at a point forty-eight miles below Folsom, bearings as below.

Midchannel. Concrete block, 15x15x15. Not dangerous except at extreme low tide.

IN TIMES TO COME

In the August issue, we finished Isaac Asimov's two-parter, "Sucker Bait." In the upcoming November issue we begin Poul Anderson's two-parter "Question and Answer." As some of you know, the Twayne Publishing Company has been running an interesting gimmick in their "Twayne Triplets"—three authors taking a single story situation, and developing and solving the problem in their own ways. Three different stories laid on the same situation-problem.

The Asimov and Anderson stories are laid on Troas, in the LaGrange system. Each has the same fundamental situation of the mysterious failure of the first expedition to Troas. But one of the really fascinating things is to see what an enormous difference of interpretation two skilled and experienced authors achieve from a single described situation!

Also coming up next month is another article by Crispin Kim-Bradley, who did the very well-received article on "Symbolic Logic and Metamathematics." This one's on the subject of paradoxes. Most of us, I think, have the feeling that paradoxes are a sort of silly parlor game, intended to plague people, not to help. Kim-Bradley makes it clear that that's far from the case. You know, commercial gas companies usually put some foul-smelling stuff in their gas before piping it out to homes. Peculiarly noxious-smelling mercaptans are favorites. It's done to irritate their customers. If the gas pipes spring a leak somewhere, natural gas doesn't irritate anybody—it just explodes. The mercaptans serve to call attention to the situation that a leak exists.

Ever think that paradoxes serve the same sort of purpose in a logic system. If you can get something to leak through the logic network, and raise a stink, it means you had better repair the system before something explodes! THE EDITOR.

THE REFERENCE LIBRARY

By P. SCHUYLER MILLER

BESIDE PHYSICS

THE phenomena which have for some time been known as ESP, and which are now preferably classed as "psi"—telepathy, clairvoyance, psychokinesis, and the rest—have embedded themselves deeply in science fiction, and have built up around and over themselves quite a formidable structure of scar tissue.

Two novels which may, as you read this, be battling it out for the place of best science fiction of 1953, Bester's "Demolished Man" and Sturgeon's "More Than Human," dealt wholly with *psi* and there were few other books in the science-fiction field which didn't use it to some degree. Meanwhile some science-fiction writers insist that these phenomena are hallucinatory, and stories using them are as much fantasies as those based on time travel, a fourth physical dimension, or fairies. Meanwhile, too, a substantial science of parapsychology has been growing up to investigate *psi* effects by laboratory methods. And it appears that the *psi* of fiction and the *psi* of Duke University are not quite the same . . .

The reader or writer who has wanted to ferret out the seeming facts of laboratory-*psi*, and especially to keep abreast of current work and findings, has had to locate a library which buys and files Dr. J. B. Rhine's "Journal of Parapsychology" — now seventeen years old. In this country, at least, the book-summaries of the field have been limited to Dr. Rhine's "The Reach of

the Mind" and "Extra-Sensory Perception"—1947 and 1934, respectively—or the volume which he helped to edit, "Extra-Sensory Perception After Sixty Years" (1940).

Now, in "New World of the Mind" (William Sloane Associates, New York 1953. 339+xi pp. $3.75), Dr. Rhine brings the matter up to date with a book which is by no means a laboratory-manual for would-be experimenters, nor yet a summation of the evidence and refutation of criticisms, but a kind of adding-up of what *psi* seems to be, how it relates to other fields of science, and what vistas it opens for future exploration.

Certain things need to be made especially clear in considering Rhine's work. He is *not* dealing with so-called "spontaneous" instances—the spectacular cases in which a ghost appears, a tragedy is foreseen, a "poltergeist" teleports inkwells, a cat comes across half a continent, a clerk breaks the bank of a gambling house. He and his associates do study such occurrences and try to evaluate their reliability as evidence, but in their own laboratories they are working on an entirely different level, with minute, quantitatively measurable effects demonstrated under reproducible conditions, with as many variables as possible carefully controlled and the results subjected to searching statistical analysis.

To quote Dr. Rhine: "While it is doubtful if any fair-minded person could read these cases by the hundreds without being profoundly impressed, I repeat that to the investigator in parapsychology such anecdotes are valued not as evidence but for suggestions they give of still undiscovered areas that offer possibilities for further researches."

The ESP or *psi* of science fiction is an overt, conscious thing possessed and utilized by certain gifted individuals, or by whole races. It is commonly assumed that these are what Charles Fort called "wild talents," possessed now by a few rare individuals but destined to become a power of *Homo superior*, the coming race. Some hold that the *psi* forces—telepathy especially, and perhaps psychokinesis and teleportation—can and will be duplicated by mechanical or electronic devices.

But the *psi* which Dr. Rhine has found in his laboratory is not like that at all. It is a thing of the *unconscious* mind, and though he has set making it conscious as one of the goals of experiment—since in the high-voltage spontaneous cases it does seem somehow to blast through into consciousness—he insists over and over that he has no laboratory evidence that it can be done.

A corollary to this is the implication that *psi* is a property of the old, formative, possibly pre-human nervous system, as are many other things which psychiatry has found buried in our unconscious. There is evidence that some animals, such as homing pigeons, dogs and cats which find their way to abandoned homes or "lost" owners over great distances, and Lady, the famous "thinking horse," also possess these properties.

Score one against the science fiction stereotype: *psi* seems to be something we're leaving behind us as we evolve and lose the need of it, not something we'll all possess a thousand or ten thousand years from now.

Add a couple of tied points: there are "gifted" individuals, and—mainly on the strength of the spontaneous cases—the possibility of gaining conscious control of these senses and forces can't be totally abandoned.

Psi, the experiments show, seems to be the expression of something which

exists *beside* the physical world, which is capable of interacting with it but does not appear to be bound by some of its basic laws. Unlike any form of radiation, it is not affected by distance, either in space or in time—which makes a kind of physical sense in a world in which we must think of space-time as an inextricably welded frame of reference. It does, on the other hand, obey *psychological* laws of its own which are similar to those governing—that is, describing—other mental processes such as memory.

The obvious implication, and the point which acts like a stuffed owl in a crow roost to so many of Rhine's critics, is that there does exist a world of the mind, which is not physical and not mechanical but exists *beside* the physical world. It is in no sense supernatural: but Rhine feels that because of the deeply ingrained reaction against "psychic "matters and against the very concept that there is a thing, "mind," independent of the resultant action of millions of cells, psychologists have been afraid and still refuse to explore any area of mental behavior which seems to involve non-physical relations.

The average person forms his ideas about *psi* from what he has heard—or, occasionally, experienced—about the spontaneous cases. In the recently published autobiographical sketches by Sir Leonard Woolley, the noted archeologist, "Spadework," there are two examples of what he considers odd and rather humorous coincidence, but which might just as well be clairvoyance or precognition. In one Woolley "spotted" the locations of the Egyptian Pharaoh Akhenaton's family temple and *harim:* later, at the Hittite capital Carchemish, he "called" the locations of two buried statues of lions, one statue of a man—the Hittite god Atarluhas—and the statue's broken-off head before anyone started to dig and before anyone knew such things existed. Such cases stand or fall on the credibility of the witnesses, and cannot ordinarily be repeated or controlled.

The laboratory tests of the parapsychologists, on the other hand, are designed to be reproducible and their evaluation is almost wholly a question of statistical probability—unless you hold that the experimenters are liars or deluded. And I miss in this book any discussion of the *statistical* attacks which have been made on Rhine's work—he merely cites a clean bill of health from the American Institute of Mathematical Statistics in 1937, before the really heavy mathematical artillery was drawn up against him—because on his probabilities he stands or falls.

I have seen—and must confess I can't now find my references—two types of statistical attack on Rhine's card-guessing experiments. One argues that the probability of a very high score must be based on the total of all card-guessing runs made by anyone, anywhere, ever, and that if this is done all high positive scores will be offset somewhere by someone's high negative score, and the whole thing will even out. This seems to me to obviate any calculations of probability in any matter, until the entire past, present and future of the universe is fully known: anything can happen.

The other, which may have more meat in it, is the kind of thing which led in the physical world to relativity. This school says that Rhine, and everyone else, has been using the wrong probability mathematics. The right mathematics will be that one in which the ESP scores are by definition normal and probable. If this new mathematics can then be applied to

probabilities in mechanical and physical matters, and describes experienced reality, then and only then these critics may have an "answer" to *psi*.

Unless you're the kind of person who automatically turns his back on any story which involves telepathy or any *psi* effect, you will almost have to read "New World of the Mind" in order to know what the world's foremost exponent of the reality of *psi* believes he has demonstrated, and believes his demonstrations mean. And before you sniff at "ghost-chasers" let me quote Rhine again:

". . . It would be scientifically unthinkable to consider any of these reports of spontaneous occurrences as acceptable proof of anything. It is quite enough to take them as things that people say happen to them; and when enough people say the same kind of thing, no matter how strange and incredible it may be, it is wise to look into the facts, letting the interpretation wait. . . . How can progress be made if all the puzzling things that occur in nature are ignored and if scientists refuse to study what they cannot at once explain and what some people call impossible?"

Atomic bombs, for instance. Or the relativistic increase in mass as velocity approaches that of light.

YOU SHALL KNOW THEM, by Vercors (Jean Bruller). Little, Brown & Co., Boston. 1953. 249 pp. $3.50

This novel by the French artist and poet, Jean Bruller, is not consciously science fiction at all. Yet it deals with a theme and a question which is also at the root of two recently republished stories by expert science-fiction writers: Robert A. Heinlein's "Jerry Was a Man" and Walter A. Miller, Jr.'s "Conditionally Human." The question: What is Man? How shall you know him?

This lacks the fantasy of the mutated, manufactured "human" apes in the other stories. An expedition to New Guinea finds a colony of "tropis" —creatures somewhere on the level of *Pithecanthropus* or the new African fire-apes. They make flint tools, have a kind of language, bury their dead, can be taught to perform simple tasks.

Then a promoter sees his opportunity: use the tropis as beasts of burden. And another opportunist follows his lead: if the tropis are not men, shouldn't we reassess our ideas about the Australian natives, the Africans, any race sufficiently in the minority so that they can be legislated back into a convenient beasthood and treated like inedible cattle?

Douglas Templemore, an English journalist who was a member of the expedition, forces the issue. What is man is a question which the courts of the world have never answered: and they must answer it to give legal meaning to any action to protect the tropis. He becomes father of a hybrid child by insemination; deliberately kills it; announces his deed and goes on trial. If he is convicted of murder, it can only be if the tropis are human; if he is acquitted, it can be only if they are apes.

More quietly, less emotionally than in "Conditionally Human," less melodramatically than in "Jerry Was a Man," the situation is played out. There is, of course, mild satire here in the reaction to Templemore's deed and the way the British go about answering the question. But the question itself is one which is always at the root of most science fiction about other races on other worlds. What—*really*—is man?

If you turn to science fiction for

more than entertainment, you owe yourself this book.

STARMAN JONES, by Robert A. Heinlein. Charles Scribner's Sons, New York. 1953. 305 pp. Ill. $2.50

It should be no news to you by now that I consider Robert A. Heinlein's books for teen-agers, published by Scribner's, close to the best in main-line science fiction that's being written today.

By "main-line," of course, I mean stories in which the backgrounds are meticulously worked out and the story grows out of them. That the heroes are young people in no way detracts from them—unless you're the kind who is ashamed to be seen reading "Tom Sawyer" because it's about "kids."

Here Heinlein leaves the solar system for the first time and accompanies Max Jones, would-be astrogator, from a hill farm to spacewreck on a hostile world, lost in the depths of the galaxy. He's on the ship with forged papers, he's on bad terms with his superiors, he's custodian of a Hesperian spider-puppy named Mister Chips and pestered by the puppy's attractive owner, he's captured by carnivorous centaurs . . . well, a lot happens and happens fast.

ASSIGNMENT IN ETERNITY, by Robert A. Heinlein. Fantasy Press, Reading. 1953. 256 pp. $3.00

Here are four Heinlein novelettes and short stories, two of them published here in 1941 ("Elsewhen") and 1949 ("Gulf"), the others in other magazines. The latter are "Lost Legacy" and the often-reprinted "Jerry Was a Man." I'd place them well ahead of "Sixth Column," possibly ahead of "The Puppet Masters," but not up to the best in the "Future History" series or the author's recent teen-age books.

"Gulf" is a story even newer ASF readers may remember: a short novel of planetary intrigue in which an agent of the Federal Bureau of Security, trapped by a mysterious enemy, finds himself forced to depend on an even more mysterious ally with seemingly supernormal powers. The same theme reappears in "Lost Legacy."

Of the two shortest stories, "Elsewhen" is a mild episode in which a group of students travel mentally into other worlds, and "Jerry Was a Man" is the story of a humanized chimpanzee.

THE TIME MASTERS, by Wilson Tucker. Rinehart & Company, New York & Toronto. 1953. 249 pp. $2.50

I'm afraid that the thoroughly corny title of this latest Tucker tale will put off some readers who shouldn't be.

It's another men-from-Space-are-among-us story, told with a mystery technique—but Gilbert Nash, the "time master" of the title, becomes almost believable as he searches for the strange Carolyn Hodgkins. Perhaps this is because, once on Earth, he has wholly human limitations along with his immunity to time.

The jacket-blurb writer, hinting about "the future against the past," tries to give the impression that this is just another time-travel plot. It isn't. What it is is revealed fairly early—about two-thirds of the way through the book—as Nash tells Shirley Hoffman, FBI agent's secretary, the story of Gilgamesh the eternal man of

ancient Babylonia. But why should I spill the secret of a good, if not outstanding, book?

FURTHER BOOKS RECEIVED

(British Publications)

THE HISTORY OF ASTRONOMY, by Georgio Abetti. Sidgwick & Jackson, London, 25/–d.

Excellently translated from the Italian, with a foreword by the Astronomer Royal, Sir Harold Spencer Jones, this book by the distinguished Italian astro-physicist Professor Georgio Abetti traces the development of astronomy from the earliest civilisations to the present day.

The work is split up into three sections: "From the Beginning to Copernicus"; "Reformation of Astronomy" and "The Modern Era." Whilst the earlier sections are of immense interest and justify to the full the title of Signor Abetti's book, it is the last-named section which receives the most detailed treatment.

THE HISTORY OF ASTRONOMY contains a wealth of information which should prove a valuable guide to the subject for the general reader of scientific taste. For the more serious student, there is plenty of technical data concerning the equipment and methods of several of the World's most modern observatories and there is also a fine selection of photographic plates illustrating the various instruments used and shewing some magnificent celestial observations.

WEST OF THE SUN, by Edgar Pangborn. Robert Hale Ltd., London, 1954, 9/6d.

Here is a story of "galactic pioneering"—necessarily imaginative and a brand of science-fiction, with accent on the fiction. However, Mr. Pangborn treats his subject with every seriousness and sends a band of five space travellers to the planet Lucifer: here they encounter all manner of strange folk and even stranger adventures and, as the story unfolds itself, events become "curiouser and curiouser."

WEST OF THE SUN can be recommended to all lovers of the adventure story and is told with a commendable zest and fine talent for description.

BRASS TACKS

Dear Mr. Campbell:

I'd like to comment on Dick Ryan's letter in one point: that is, that it is very difficult to rate the quality of stories. I'd like to point out that it will be difficult to find a type of story that the readers will most prefer, by comparing and contrasting the story-ratings of the An. Lab. The ratings of the stories depend largely upon the issue in which they appear. A story which rates first in one issue might be low on the scale had it appeared in the following issue, merely because the overall quality of the stories in the second issue was better. And the editor will have no way of knowing this, nor will the readers as a whole.

Similarly, a different group of people will report to the An. Lab. each time. As a result of this, the difference of preference of story-type will not be accounted for. Then again, peoples' tastes change from time to time, and after a while even a given group will change in its preference. Therefore, if you're looking for a "common denominator" in story-preference, you are liable to find that you actually have nowhere to begin.

The An. Lab. will show only how good a story was in comparison with the rest of the stories in that particular issue. It will not show how good they were in comparison with the previous issues' stories. The point-score you get, then, of one given story is not that which it would be were it compared with all the stories of the previous five years. I would not be surprised to find a story rated, say, 2.55 in an An. Lab. coming up to about 1.50 in an overall five-year reader impression. This would also mean that the stories rated better than it in the issue in which it appeared were even better than 1.50 for the five-year period. Yet this story would show up on your graphs as "middling," since you would not have that comparison with

the previous five years to show you how good it actually was. As a result, you would be thrown off the track entirely when you looked for a common denominator of reader preference, since you would have absolutely no way to know that this "middling" story was really top-notch. There's no way to know even nearly how good a story is until you have looked back and seen what the lasting impression is.

I'm not advocating throwing out the An. Lab.—it's interesting to see the opinion of one issue, though I always wonder just how good the first-place story really was. But a batch of An. Lab. reports will *not* help you very much towards finding what kind of stories the readers prefer. In the end, you'll have to fall back on what you've been doing all along—select them yourself, and hope what you like is what your readers will like. Taking a look at ASF's record, I don't think you've been unsuccessful at it. In fact, your own opinion seems to be a very good one. I think you've already found your common denominator.—Dick Clarkson, 410 Kensington Road, Baltimore 29, Maryland.

There is the somewhat tautological proposition that the long-term readers of the magazine must think rather as I do, because otherwise they'd have gotten bored and quit reading.

Dear Mr. Campbell:

Due to the unpredictable schedule of the mail boats, I have only recently received my April issue of Astounding, and indeed got my May issue today, only a few days later. As usual I have found Astounding an excellent gift from home, but there are a few points that I am not quite happy about in Mr. James Blish's story in the April issue, "Earthman Come Home." Please understand that I found this story an entertaining one and my criticism is not offered so much as criticism *per se*, but as a doubt that his economic themes are ones which would ever materialize, given a culture such as he has described. Let me summarize:

1) It seems unlikely that our heroes could not repair their own motive apparatus since Amalfi apparently was quite capable of checking over, and operating the relatively unfamiliar propulsion units of IMT in a relatively short time. The only other possible reason for this inability to repair the city's propulsive units would be lack of capital which seems unlikely from other characterizations of the city's resources.

2) The city was pictured as being defeated in an economic sense by the breakup of the germanium standard. I grant you that a very widespread and possibly long-lasting depression may very well result from a collapse of monetary standard, indeed our own world still feels very definite effects from the widespread withdrawal throughout the world from the gold standard; but isn't it equally true that a versatile and efficient economic entity will always be more solvent than less efficient fabricators, traders, or entrepreneurs in general? That the city was such an economic paragon is implied and indeed stated. Why then, were they less able to cope with the depression brought on by the monetary collapse? They did not exist primarily as fabricators or producers of germanium.

3) The other factor in the collapse of the city's economy was given as the need for the anti-athapic drugs which had become the basis for monetary standards. Here again, it seems

t

to me that Mr. Blish is being very cavalier with certain facets of human nature and certain rather basic economic realities, to wit: the desire for the life-prolonging drugs as drugs would certainly not be limited to the Okies; every man rich enough except perhaps a few philosophers—and I wouldn't care to bet on many of them —would be using them as drugs. The situation would eventually be resolved through supply and demand, and as always, the demand would be measured in the ability to pay, which in turn might depend on many factors where an individual is concerned, but in the case of an economic unit, would depend in the long run on initiative, efficiency, et cetera—in short the qualities that make all the wheels go round, modern welfare states notwithstanding. If one accepts my premise as reasonable in principle, we come right back to my original argument that the city, having proved itself an efficient economy during some three thousand years, would go right on being such an economy barring collective ennui, or failure to keep up with advancing technology. Neither of these possibilities was advanced as reasons for the city's losing ground, so to speak, even though they both would exist certainly to some extent; even with advanced psychiatric techniques, it seems likely that three thousand years would wear on one's psyche. As a matter of fact this has been the theme of several of your excellent stories of years past. My own theory of the future and eventual demise of an entity such as the city pictured in Mr. Bliss' story? Here I stick my neck out: a gradual tendency towards more play and less work, towards getting other people to do what work has to be done, the replacement of a stoic or semi-stoic attitude towards life to a pseudo-epicurean one without the saving graces so explicitly stated by the man who gave that philosophy its name, and finally inundation by more virile peoples—in short the same thing that has happened to every great world culture up to our own time, and what seems to be happening to our own United States right now. Some of these characteristics were brought out in Mr. Bliss' characterization of IMT, but it seems to me, this characterization lacked consistency, as does his picture of the "good city."—Erich Rolaff, P. O. Box 117, Singapore.

In other words—if you are doing a good job, you can make a living in any economy!

Dear John:

I hate to do this to a writer as good as Ralph Williams, and "Bertha" was a fine yarn, however . . .

Williams computed his orbits beautifully. His vectors check. His space medicine jibes. Very, very nice. But he made one *gross* error which causes the yarn to fall flat on its face.

Everything in the yarn was technically correct. Except for one fact:

If Bertha was there, we could see it.

Bertha's diameter was given as 80 feet. Its orbital distance was given as 1500 miles above the surface, making it 5500 miles from the center of the earth. Assuming a conservative value of 7% for albedo and full phase reflection, the object would have a magnitude of 0-2. A nice, bright star. Even if it had a mirrored finish, it would be of about 5th magnitude. Flat white, it would be 0. Its sidereal drift rate would be 171-degrees-per-hour, and its apparent drift rate seen from the surface with the object on the meridian would be 570-degrees-per-hour.

I claim no credit for these figures,

because they are not mine. They are Clyde W. Tombaugh's.

I just got through discussing this with Tombaugh, who is the astronomer who discovered the planet Pluto in 1930 and who is now at White Sands Proving Ground. Any astronomer could have computed the figures quoted above, but Professor Tombaugh is the only one to my knowledge who has done so.

I cite my conversation with Tombaugh as well as the document I have before me. It is an Ozalid copy of a Project Proposal entitled, "Search for Small Satellites of the Earth," by C. W. Tombaugh. Certain portions of this have recently been released, which allows me to write this letter. Using techniques which he has developed, Tombaugh is at present engaged in searching the vicinity of the Earth for small satellites. To give you an idea of *how* small, Tombaugh can find and see a clean, white tennis ball in orbit 1000 miles above the surface. He can see a V-2 rocket, painted as we paint them at White Sands, in a broadside attitude *at the orbit of the Moon!*

And he's using less than 24″ of aperture. An 8″ Schmidt, F:16, to be exact.

Williams made the assumption we couldn't see Bertha. A 1-magnitude star galloping across the sky and going 570-degrees-per-hour would be so obvious you couldn't miss it. It could be as small as 12-feet in diameter and you could still see it with your naked eye.

Mr. Williams made the assumption, as nearly everybody would do, that you couldn't see it. The calculations Tombaugh has done as part of his project prove you can.

Another interesting point has arisen also. One would think a mirrored surface on that sphere would make it more easily seen. Such is not the case if you will remember your laws of optics pertaining to convex mirrors. A body painted flat white would show up best. A dark body is out of the question; the paint would blister and peel, exposing bright surfaces. Even assuming a mirror surface, Williams' Bertha would appear as a 4-5 magnitude object.

However, a mirrored surface wouldn't last long. This we know. Even the hardest substance will be pitted by tiny meteorites until it becomes frosted—and, therefore, more easily seen.

Bertha isn't there! And if there are Berthas out there, Tombaugh will find them before we get out there! Did Williams think we were going out into space without looking the territory over first? Lots of people make the assumption that we don't know what we're getting into; we do. This project of Tombaugh's is only one of many U. S. Army Ordnance, U. S. Air Force, and U. S. Navy projects going on right now. We are going into space, and we are doing it in the coldest, coolest, most scientific way we can.

If Tombaugh finds something, we may have something out there to vector on and tie up to. If he doesn't, we now have a method of ascertaining when someone *does* put one up. And we can keep track of our own!

Besides discovering a planet, Tombaugh has added to his laurels with a new astronomical method. It will see other uses. This is an example of the type of people we have down here at the rocket capital of the world on the raw frontiers of the unknown beyond the sky.—G. Harry Stine.

Hey! No fair calling on author on the basis of some fact discovered after he wrote!

HER HIGHNESS

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AS HEALER

One lady writes: "My sister suffered very badly for years, but since I gave her a 'Joan the Wad' to keep near her she is much easier. Do you think this is due to Joan or the Water from the Lucky Well?"

AS LUCK BRINGER

Another writes: "Since the War my wife and I have been dogged by persistent ill-luck, and we seemed to be sinking lower and lower. One day someone sent us a 'Joan the Wad.' We have never found out who it was, but, coincidence if you like, within a week I got a much better job, and my wife had some money left her. Since then we have never looked back, and, needless to say, swear by 'Queen Joan'."

AS MATCHMAKER

A young girl wrote to inform me that she had had scores of boy friends, but it was not until she had visited Cornwall and taken Joan back with her that she met the boy of her dreams, and as they got better acquainted she discovered he also has "Joan the Wad."

AS PRIZEWINNER

A young man wrote us only last week: "For two years I entered competitions without luck, but since getting 'Joan the Wad' I have frequently been successful although I have not won a big prize, but I know that ——, who won £2,000 in a competition, has one because I gave it to him. When he won his £2,000 he gave me £100 for myself, so you see I have cause to bless 'Queen Joan'."

AS SPECULATOR

A man writes: "I had some shares that for several years I couldn't give away. They were 1/- shares, and all of a sudden they went up in the market to 7/9. I happened to be staring at 'Joan the Wad.' Pure imagination, you may say, but I thought I saw her wink approvingly. I sold out, reinvested the money at greater profit and have prospered ever since."

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